U.S. Department of the Interior
Bureau of Land Management

Willow Master Development Plan

Environmental Impact Statement

FINAL

Volume 2: Appendix A.1

Figures 1.4.1 - 3.13.6

August 2020

Prepared by:
U.S. Department of the Interior
Bureau of Land Management

In Cooperation with:
U.S. Army Corps of Engineers
U.S. Environmental Protection Agency
U.S. Fish and Wildlife Service
Native Village of Nuiqsut
Iñupiat Community of the Arctic Slope
City of Nuiqsut
North Slope Borough
State of Alaska

Estimated Total Costs Associated with Developing and Producing this EIS:
$6,668,400

Mission

To sustain the health, diversity, and productivity of the public lands for the future use and enjoyment of present and future generations.

Cover Photo Illustration: Caribou in the Alpine Development on Alaska's North Slope.
Photo by: Wendy Mahan, courtesy of ConocoPhillips.

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DOI-BLM-AK-0000-2018-0004-EIS
BLM/AK/PL-19/012+1610+F010

Willow Master Development Plan

Appendix A.1
Figures 1.4.1 – 3.13.6

August 2020

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LIST OF FIGURES

Figure 1.4.1. Willow Development Location 1
Figure 2.4.1. Alternative B: Proponent's Project 2
Figure 2.4.2. Alternative C: Disconnected Infield Roads 3
Figure 2.4.3. Alternative D: Disconnected Access 4
Figure 2.4.4. Option 1: Atigaru Point Module Transfer Island 5
Figure 2.4.5. Option 2: Point Lonely Module Transfer Island 6
Figure 2.4.6. Option 3: Colville River Crossing 7
Figure 2.5.1. Constructed Freshwater Reservoir 8
Figure 2.5.2. Tiŋmiaqsiuġvik Gravel Mine Site 9
Figure 2.5.3. Boat Ramps 10
Figure 2.7.1. Comparison of Action Alternatives 11
Figure 3.1.1. Past and Present Actions from Teshekpuk Lake to Kuparuk 12
Figure 3.3.1. Analysis Area for Air Quality 13
Figure 3.3.2. Nuiqsut Monitoring Station Wind Rose 14
Figure 3.4.1. Analysis Area for Soils, Permafrost, and Gravel Resources 15
Figure 3.5.1. Known Contaminated Sites or Spills within 0.5 mile of the Project 16
Figure 3.6.1. Analysis Area for Noise 17
Figure 3.7.1. Visual Resources Analysis Area, Project Viewshed, and Proposed Project Facilities 18
Figure 3.7.2. Visual Resource Inventory Scenic Quality Classes 19
Figure 3.7.3. Visual Resource Inventory Sensitivity Levels 20
Figure 3.7.4. Visual Resource Inventory Distance Zones 21
Figure 3.7.5. Visual Resource Inventory Classes 22
Figure 3.7.6. Visual Resource Management Classes (BLM 2012b) 23
Figure 3.7.7. Visual Resource Management Classes (BLM 2020a Alternative B) 24
Figure 3.7.8. Visual Resource Management Classes (BLM 2020a Alternative C) 25
Figure 3.7.9. Visual Resource Management Classes (BLM 2020a Alternative D) 26
Figure 3.7.10. Visual Resource Management Classes (BLM 2020a Alternative E) 27
Figure 3.8.1. Watersheds in the Analysis Area for Water Resources 28
Figure 3.8.2. Water Resources in and near the Analysis Area 29
Figure 3.8.3. Streams and Floodplains in the Willow Area 30
Figure 3.8.4. Floodplain Detail in the Willow Area 31
Figure 3.8.5. Lakes in the Water Resources Analysis Area 32
Figure 3.8.6. Proximity of Water Resources to Shore-based Action Alternatives 33
Figure 3.8.7. Module Delivery Options Marine Activities 34
Figure 3.9.1. Analysis Area for Wetlands and Vegetation 35
Figure 3.9.2. Wetlands in the Analysis Area 36
Figure 3.9.3. Land Cover Classes in the Analysis Area 37
Figure 3.10.1. Analysis Area for Fish 38
Figure 3.10.2. Fish Habitat in the Willow Area 39
Figure 3.10.3. Module Delivery Options Marine Activities 40
Figure 3.11.1. Bird Habitat Use and Analysis Area 41
Figure 3.11.2. Important Bird Areas 42
Figure 3.11.3. Spectacled Eider Pre-Breeding Density in the Analysis Area 43
Figure 3.11.4. Pre-Breeding Steller's Eider Locations in the Analysis Area 44
Figure 3.11.5. Yellow-Billed Loon Density and Nests in the Analysis Area 45
Figure 3.11.6. Yellow-Billed Loon Density and Nests in the Willow Area 46

Figure 3.11.7. Bird Habitat Use in the Willow Area 47
Figure 3.12.1. Analysis Area for Terrestrial Mammals 48
Figure 3.12.2. Annual Ranges of the Central Arctic and Teshekpuk Caribou Herds 49
Figure 3.12.3. Seasonal Distribution of Female Caribou in the Teshekpuk Caribou Herd..... 50
Figure 3.12.4. Mean Caribou Density by Season 2001-2018 51
Figure 3.12.5. Movement of GPS-Collared Caribou of the Teshekpuk Caribou Herd 2004–2018..... 52
Figure 3.12.6. Seasonal Distribution of Female Caribou in the Central Arctic Herd 53
Figure 3.12.7. Distribution of Calving Caribou of the Teshekpuk Caribou Herd 1990–2018..... 54
Figure 3.13.1. Marine Mammals Analysis Area and Polar Bear Dens, Critical Habitat, and Potential Terrestrial Denning Habitat..... 55
Figure 3.13.2. Estimated Barge Transit Route..... 56
Figure 3.13.3. Polar Bear Observations 57
Figure 3.13.4. Polar Bear Dens, Critical Habitat, and Potential Terrestrial Denning Habitat in the Eastern Analysis Area 58
Figure 3.13.5. Module Delivery Options Marine Activities 59
Figure 3.13.6. Polar Bear Potential Terrestrial Denning Habitat in the Willow Area 60

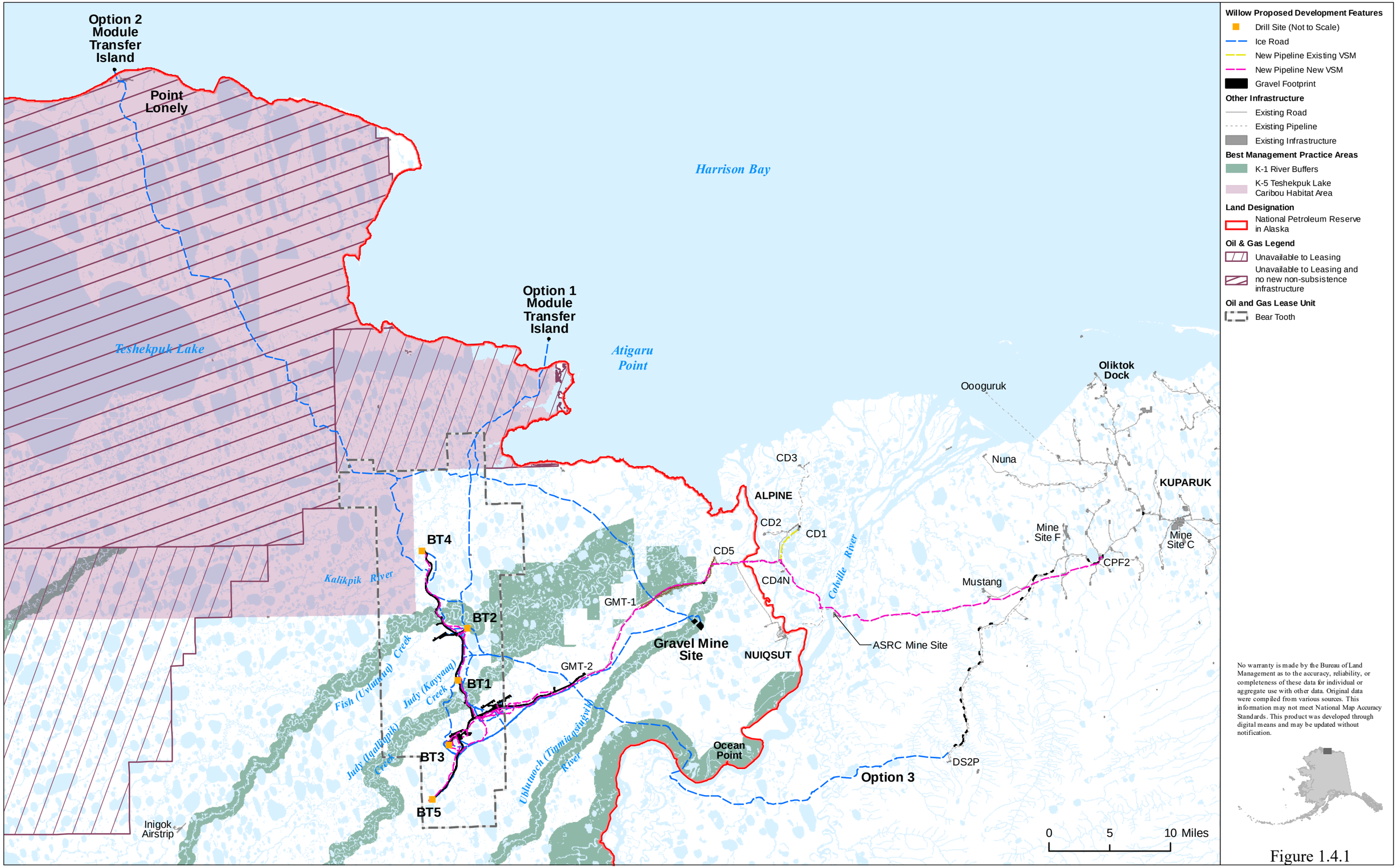
Option 2 Module Transfer Island
Point Lonely
Harrison Bay
Teshekpuk Lake
Option 1 Module Transfer Island
Atigaru Point
Oliktok Dock
Oooguruk
Nuna
KUPARUK
CD3
ALPINE
CD2
CD1
CD5
CD4N
Colville River
Mine Site F
Mine Site C
CPF2
Mustang
Kalikpik River
BT4
BT2
BT1
BT3
BT5
GMT-1
GMT-2
Gravel Mine Site
NUIQSUT
ASRC Mine Site
Fish (Uvluktuvuq) Creek
Judy (Kayyaaq) Creek
Judy (Qaalipik) Creek
Ublutuoch (Tinmiaqsiugvik) River
Ocean Point
DS2P
Option 3
Inigok Airstrip
0 5 10 Miles
Willow Proposed Development Features
Drill Site (Not to Scale)
Ice Road
New Pipeline Existing VSM
New Pipeline New VSM
Gravel Footprint
Other Infrastructure
Existing Road
Existing Pipeline
Existing Infrastructure
Best Management Practice Areas
K-1 River Buffers
K-5 Teshekpuk Lake Caribou Habitat Area
Land Designation
National Petroleum Reserve in Alaska
Oil & Gas Legend
Unavailable to Leasing
Unavailable to Leasing and no new non-subsistence infrastructure
Oil and Gas Lease Unit
Bear Tooth
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Figure 1.4.1

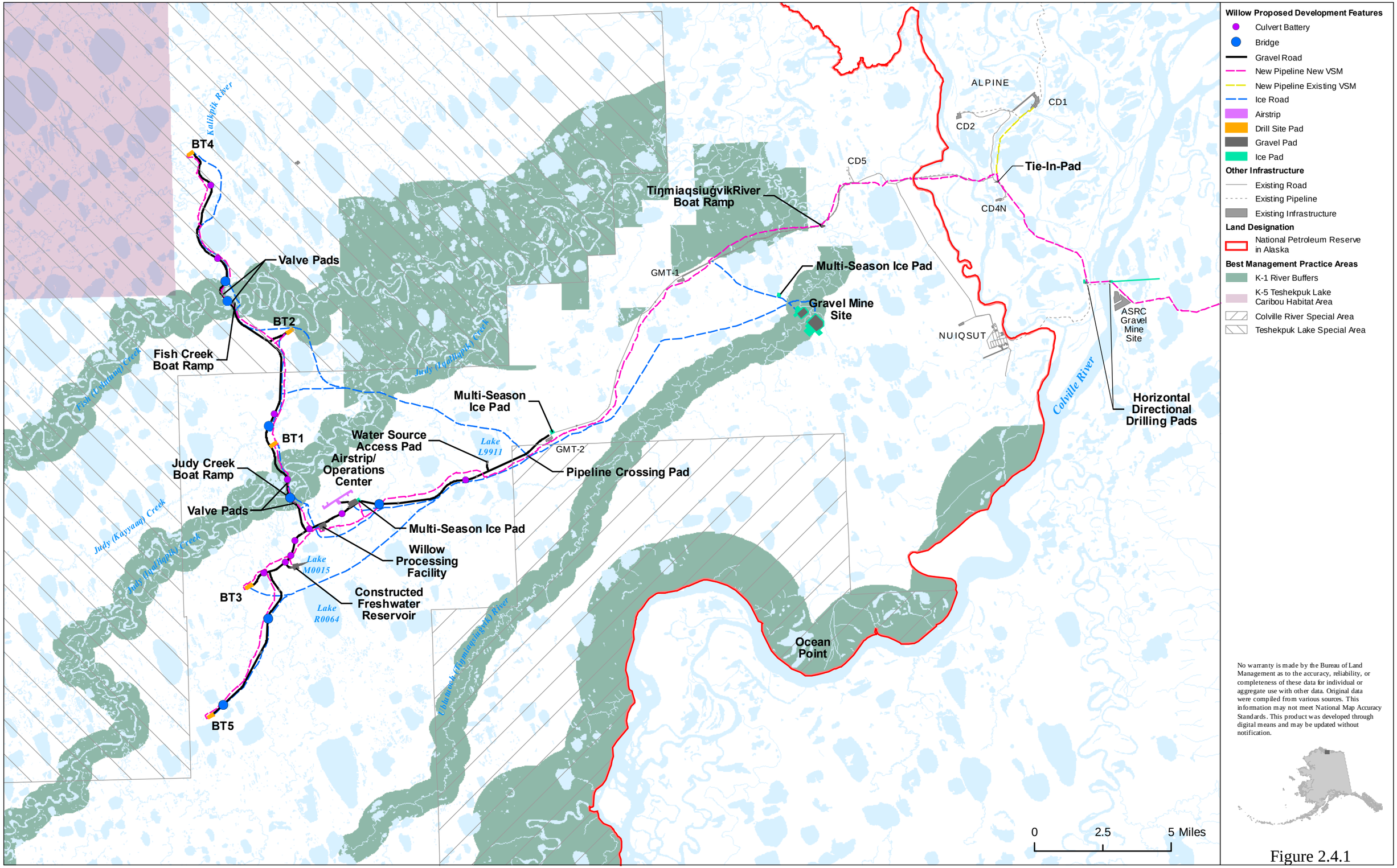

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Figure 2.4.1

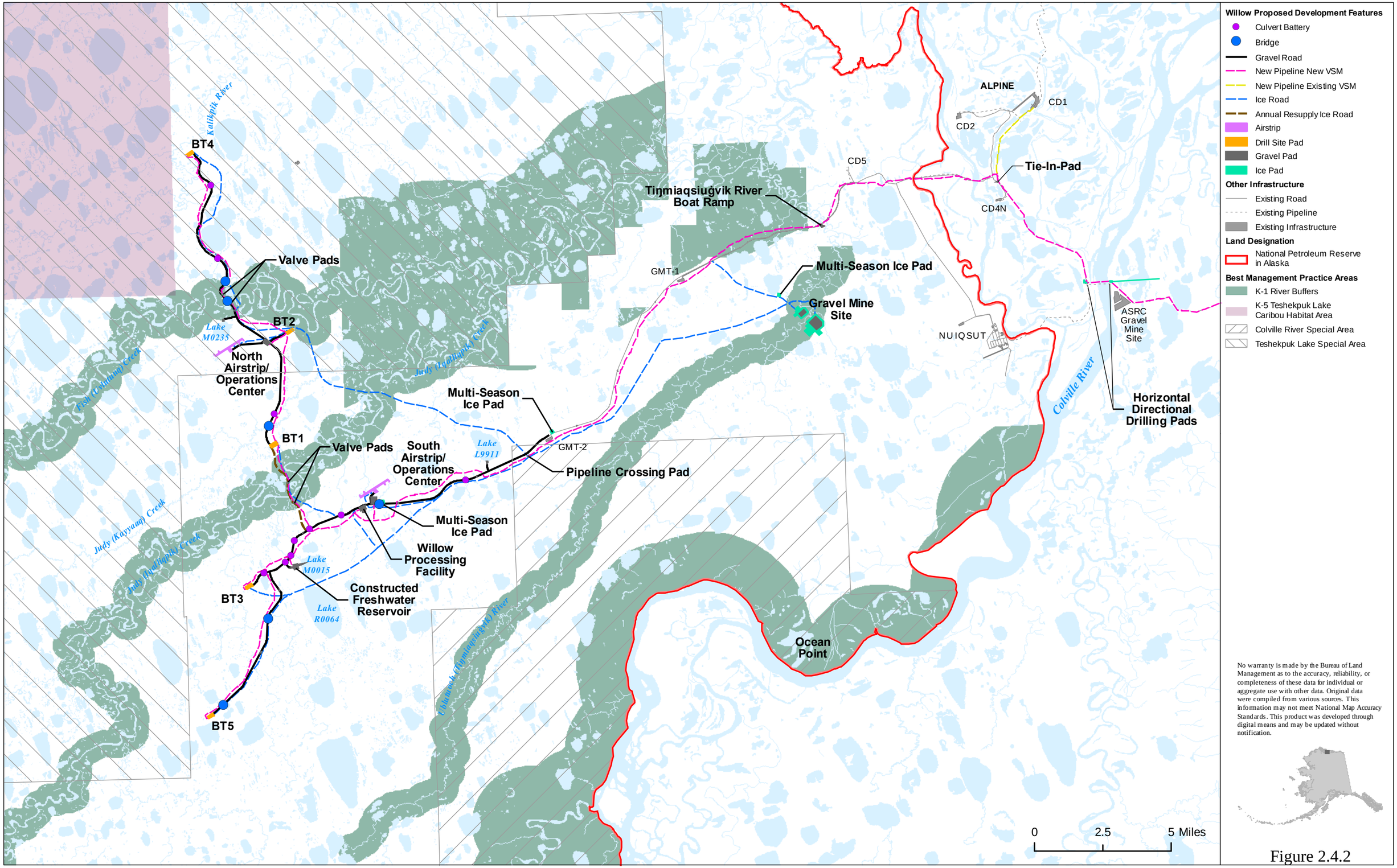

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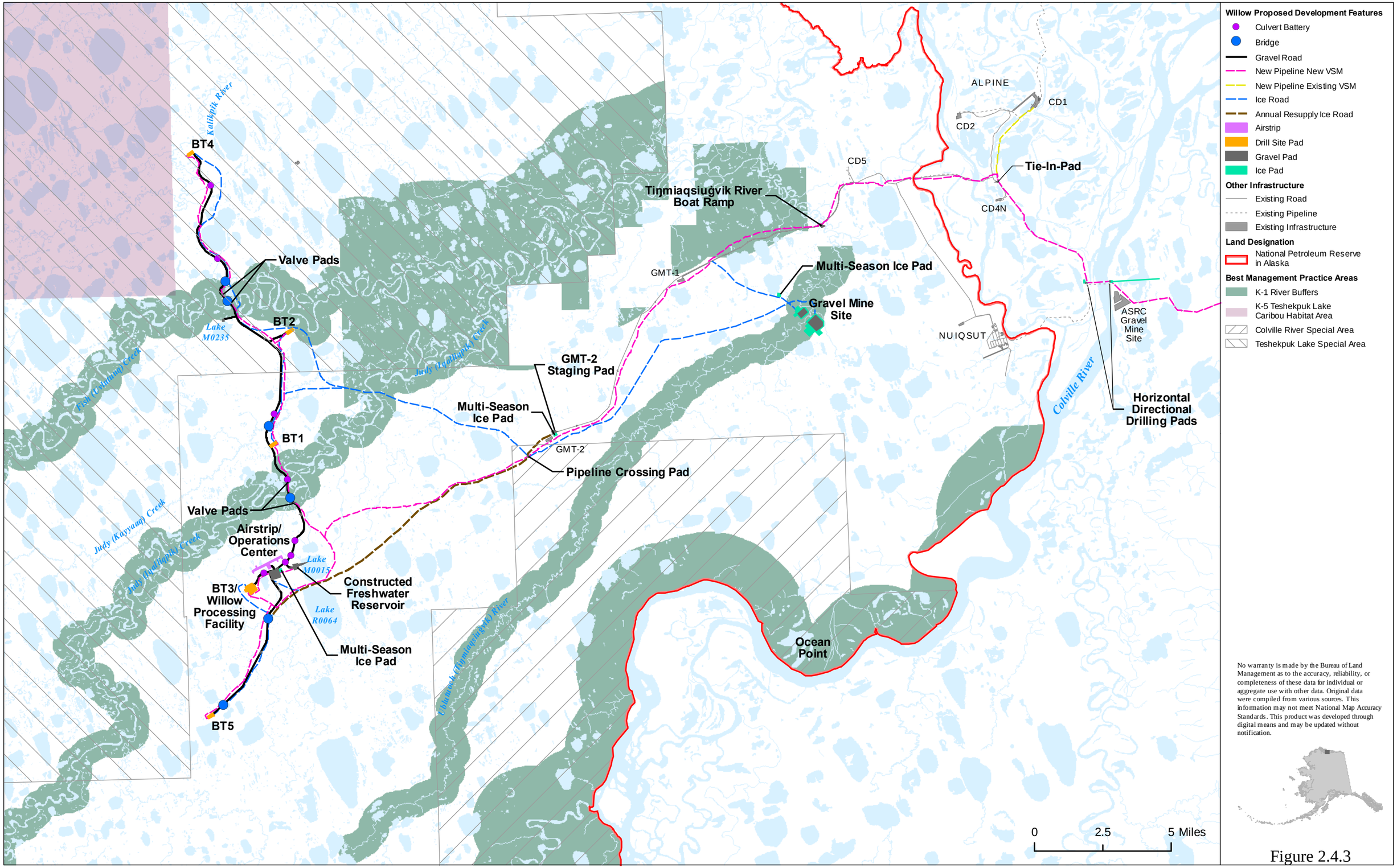
Figure 2.4.2


Willow Proposed Development Features
Culvert Battery
Bridge
Gravel Road
New Pipeline New VSM
New Pipeline Existing VSM
Ice Road
Annual Resupply Ice Road
Airstrip
Drill Site Pad
Gravel Pad
Ice Pad
Other Infrastructure
Existing Road
Existing Pipeline
Existing Infrastructure
Land Designation
National Petroleum Reserve in Alaska
Best Management Practice Areas
K-1 River Buffers
K-5 Teshekpuk Lake Caribou Habitat Area
Colville River Special Area
Teshekpuk Lake Special Area
ALPINE
CD1
CD2
CD5
CD4N
Tie-In-Pad
Tinmiaqsiuġvik River Boat Ramp
GMT-1
Multi-Season Ice Pad
Gravel Mine Site
NUIQSUT
ASRC Gravel Mine Site
Horizontal Directional Drilling Pads
Colville River
GMT-2 Staging Pad
Multi-Season Ice Pad
GMT-2
Pipeline Crossing Pad
Valve Pads
BT4
BT2
BT1
BT5
Lake M0235
Fish (Uhlaġiuq) Creek
Judy (Qalliqpik) Creek
Judy (Kayyaaq) Creek
Kalikpik River
Airstrip/ Operations Center
Lake M0015
Constructed Freshwater Reservoir
BT3/ Willow Processing Facility
Lake R0064
Multi-Season Ice Pad
Ocean Point
Ublutuoch (Tinmiaqsiuġvik) River
0
2.5
5 Miles
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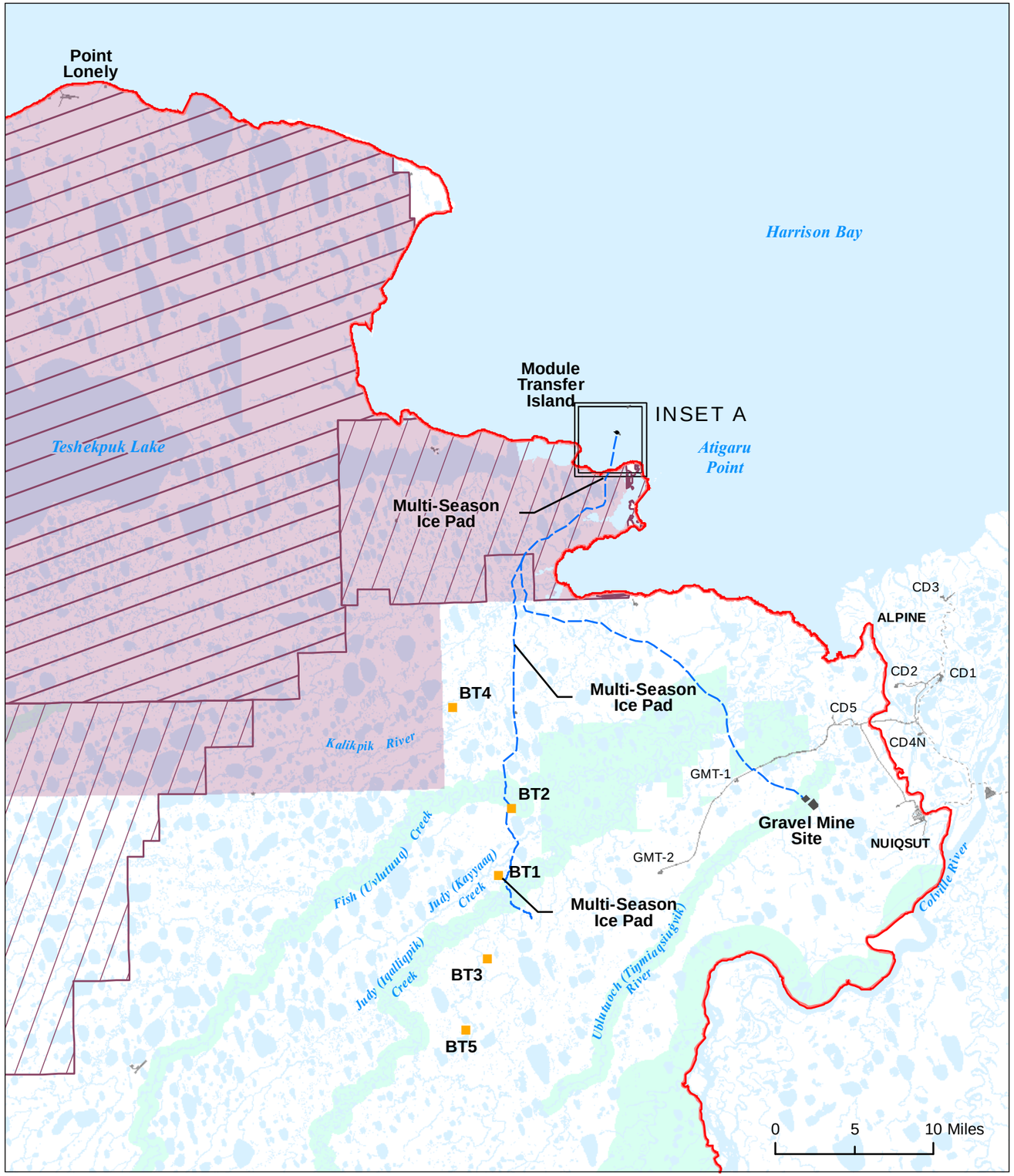

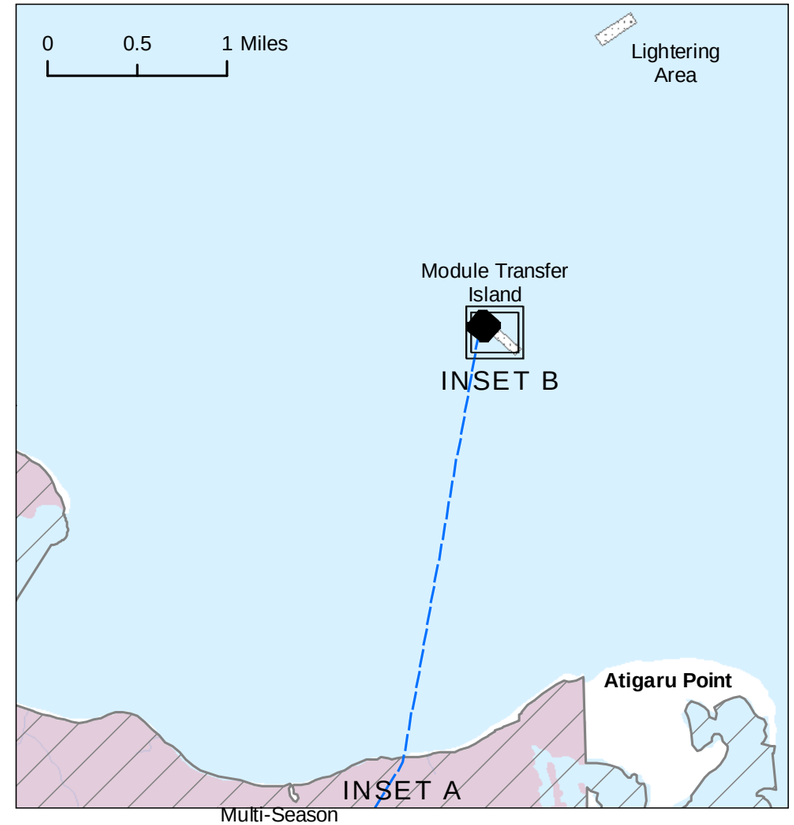

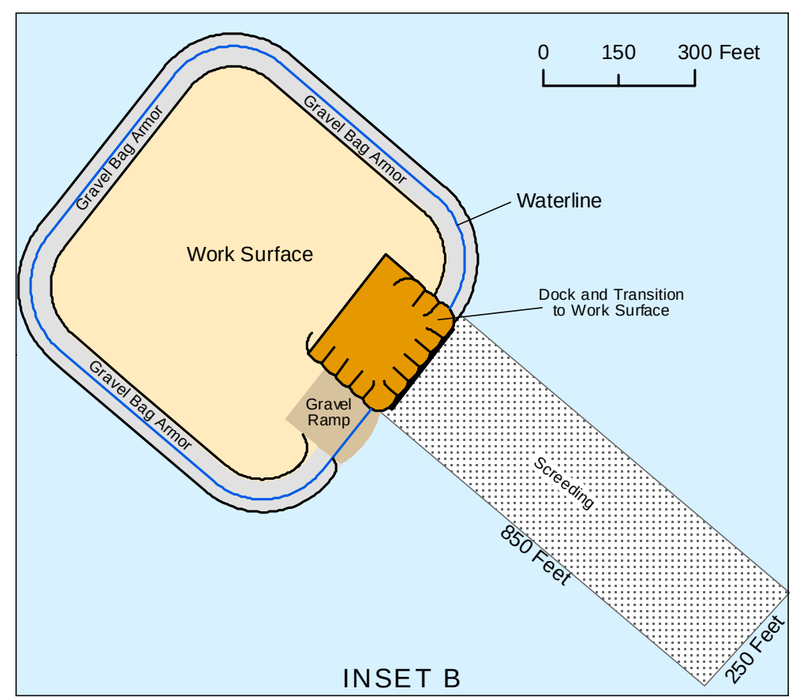

Willow Proposed Development Features
- Drill Site (Not to Scale)
- Ice Road
- Module Transfer Island
- Gravel Mine Site
- Screeding
- Ice Pad

Other Infrastructure
- Existing Road
- Existing Pipeline
- Existing Infrastructure

Land Designation
- National Petroleum Reserve in Alaska

Best Management Practice Areas
- K-1 River Buffers
- K-5 Teshekpuk Lake Caribou Habitat Area

Oil & Gas
- Unavailable to Leasing
- Unavailable to Leasing and no new non-subsistence infrastructure

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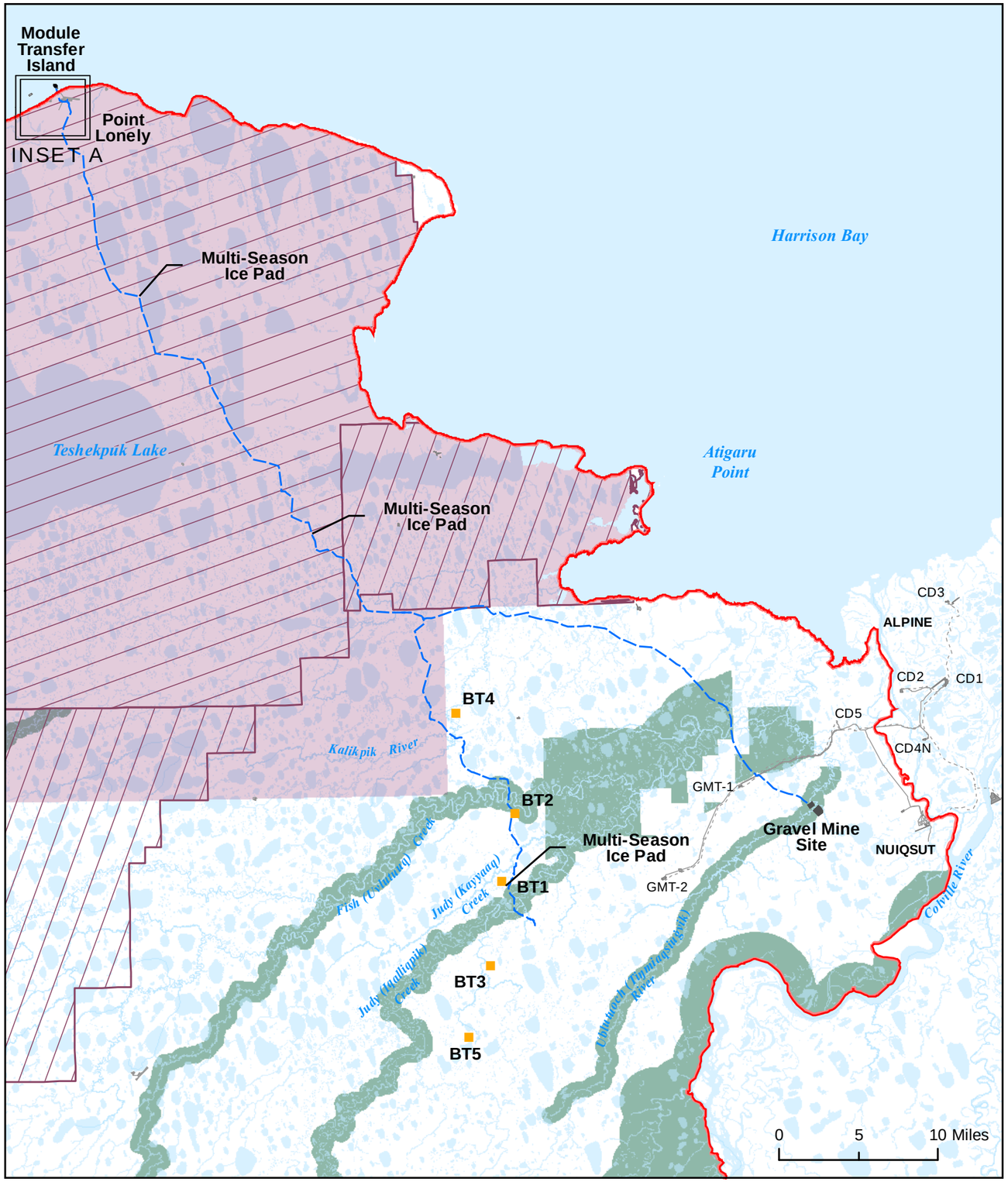

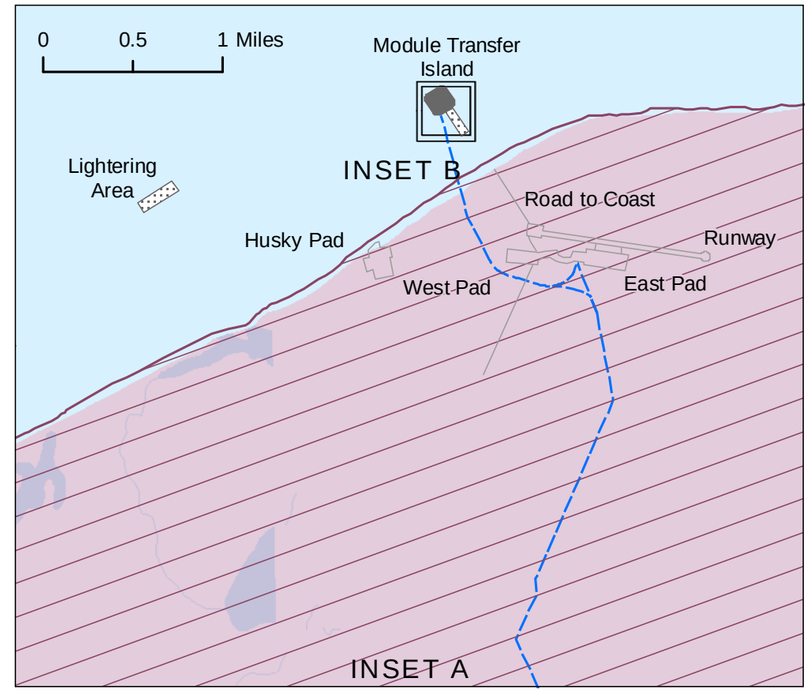

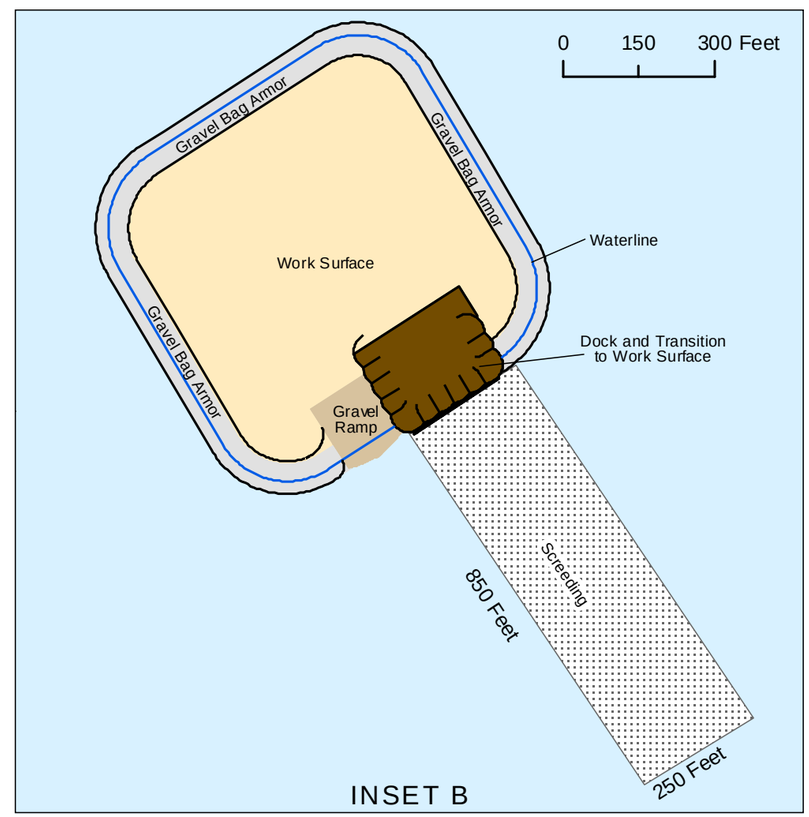

Willow Proposed Development Features
- Drill Site (Not to Scale)
- Ice Road
- Module Transfer Island
- Gravel Mine Site
- Screeding
- Ice Pad

Other Infrastructure
- Existing Road
- Existing Pipeline
- Existing Infrastructure

Land Designation
- National Petroleum Reserve in Alaska

Best Management Practice Areas
- K-1 River Buffers
- K-5 Teshekpuk Lake Caribou Habitat Area

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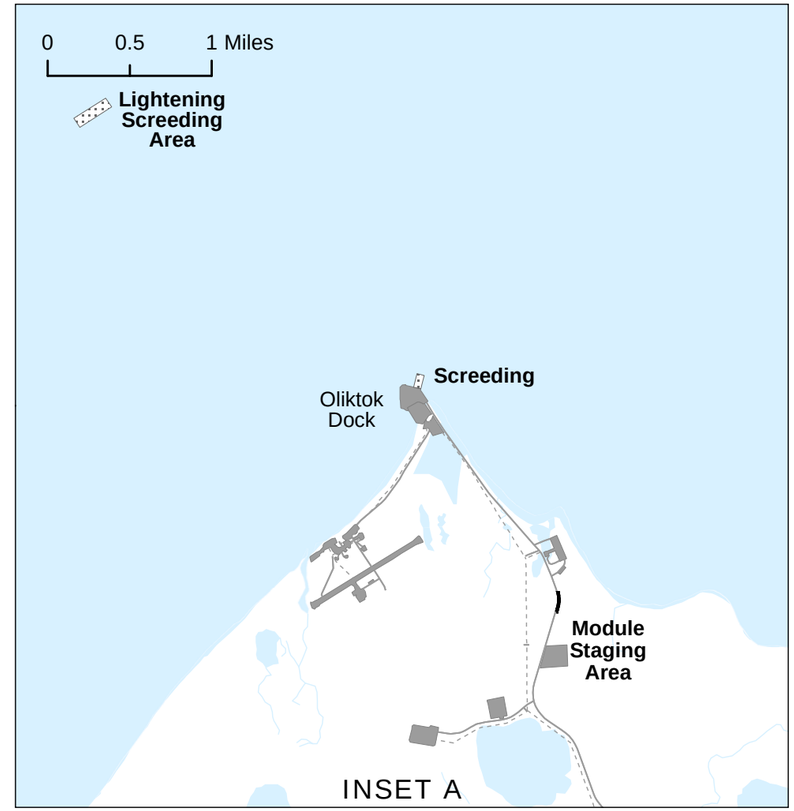
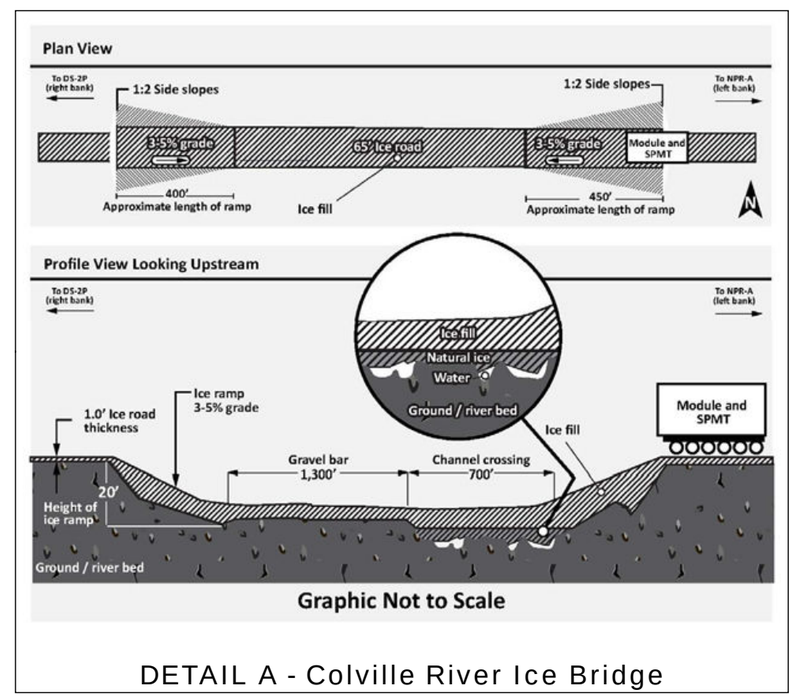
Figure 2.4.5





DETAIL A - Colville River Ice Bridge

Willow Proposed Development Features
- Drill Site (Not to Scale)
- Option 3 Existing Road
- Gravel Footprint
- Screeding

Other Infrastructure
- Existing Road
- Existing Pipeline
- Existing Infrastructure

Land Designation
- National Petroleum Reserve in Alaska

Best Management Practice Areas
- K-1 River Buffers
- K-5 Teshekpuk Lake Caribou Habitat Area

Oil & Gas
- Unavailable to Leasing
- Unavailable no Leasing and no new non-subsistence infrastructure

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Figure 2.4.6

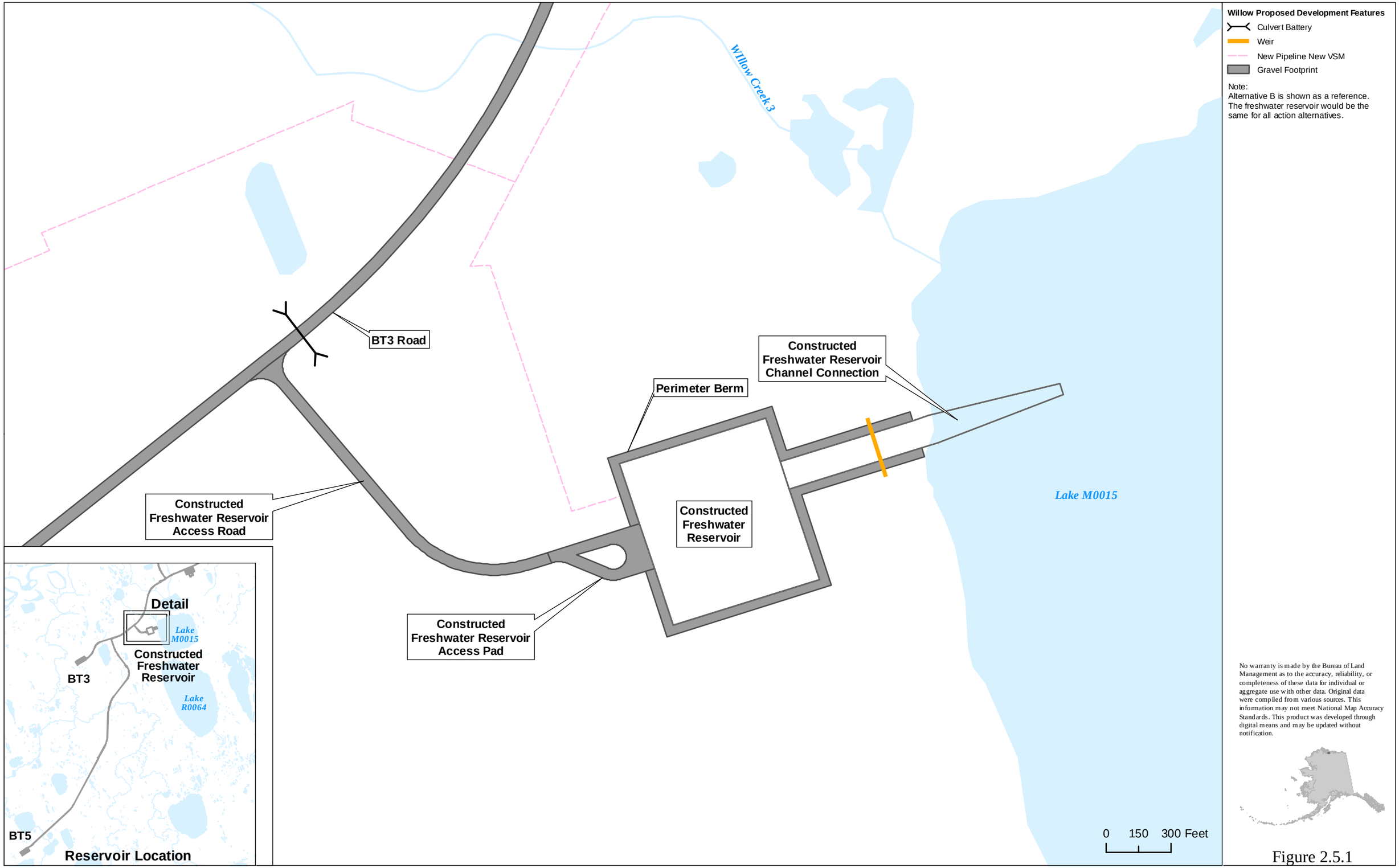
Willow Proposed Development Features
Culvert Battery
Weir
New Pipeline New VSM
Gravel Footprint
Note:
Alternative B is shown as a reference. The freshwater reservoir would be the same for all action alternatives.
Willow Creek 3
BT3 Road
Constructed Freshwater Reservoir Channel Connection
Perimeter Berm
Constructed Freshwater Reservoir Access Road
Constructed Freshwater Reservoir
Lake M0015
Constructed Freshwater Reservoir Access Pad
Detail
Lake M0015
Constructed Freshwater Reservoir
BT3
Lake R0064
BT5
Reservoir Location
0 150 300 Feet
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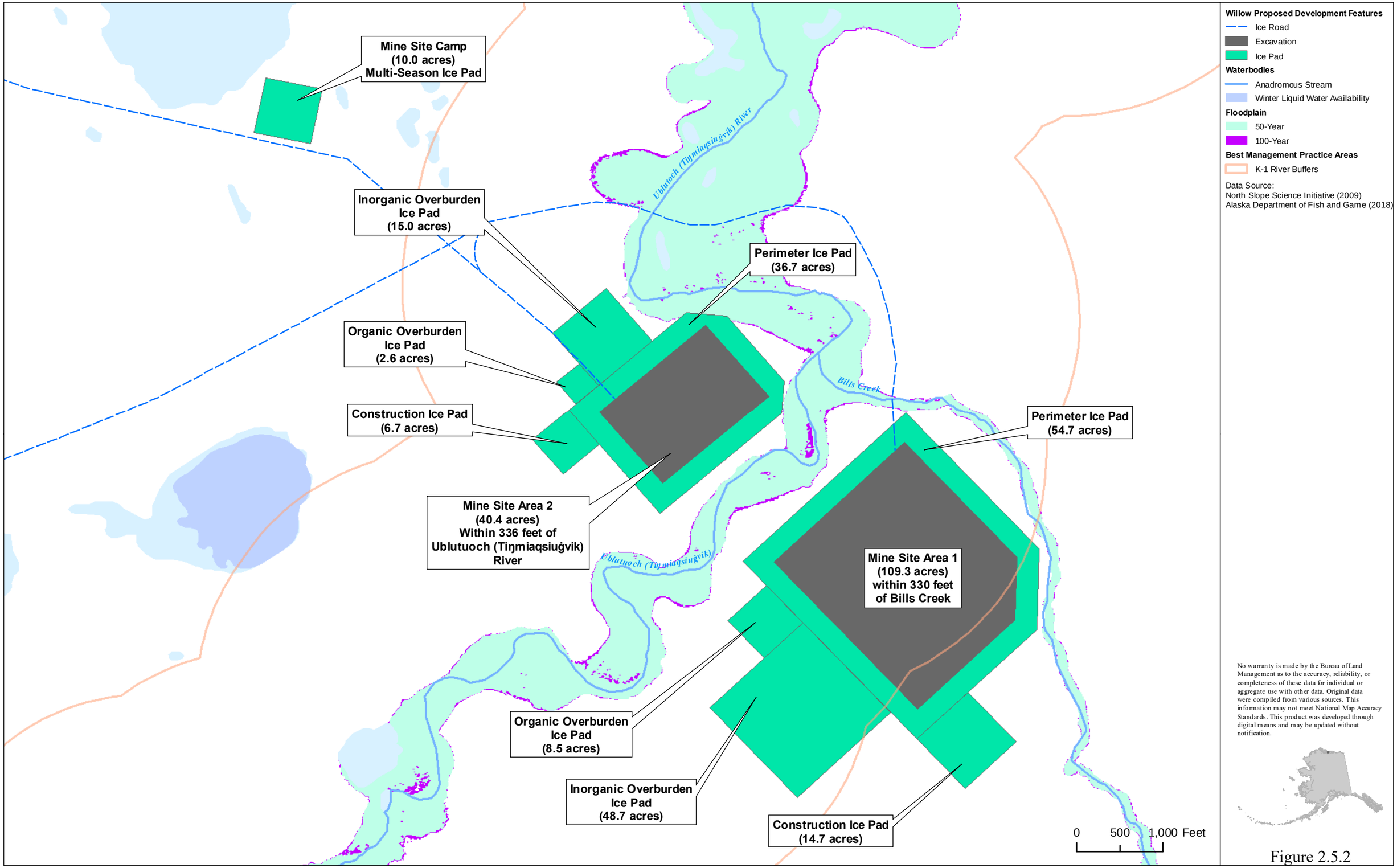
Figure 2.5.1


Mine Site Camp
(10.0 acres)
Multi-Season Ice Pad
Inorganic Overburden
Ice Pad
(15.0 acres)
Perimeter Ice Pad
(36.7 acres)
Organic Overburden
Ice Pad
(2.6 acres)
Construction Ice Pad
(6.7 acres)
Perimeter Ice Pad
(54.7 acres)
Mine Site Area 2
(40.4 acres)
Within 336 feet of
Ublutuoch (Tiŋmiaqsiuġvik)
River
Mine Site Area 1
(109.3 acres)
within 330 feet
of Bills Creek
Organic Overburden
Ice Pad
(8.5 acres)
Inorganic Overburden
Ice Pad
(48.7 acres)
Construction Ice Pad
(14.7 acres)
Ublutuoch (Tiŋmiaqsiuġvik) River
Bills Creek
0
500
1,000 Feet
Willow Proposed Development Features
Ice Road
Excavation
Ice Pad
Waterbodies
Anadromous Stream
Winter Liquid Water Availability
Floodplain
50-Year
100-Year
Best Management Practice Areas
K-1 River Buffers
Data Source:
North Slope Science Initiative (2009)
Alaska Department of Fish and Game (2018)
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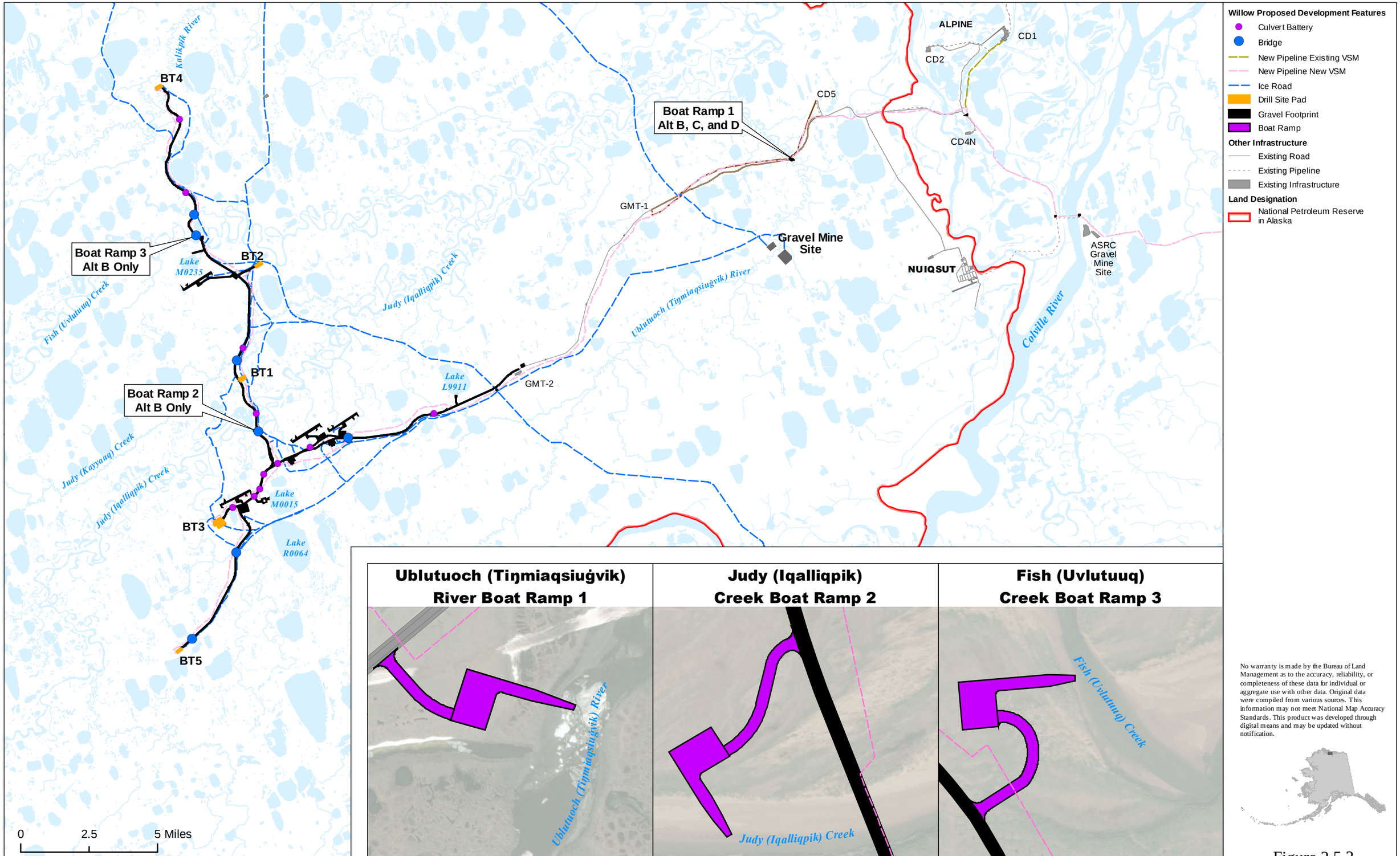

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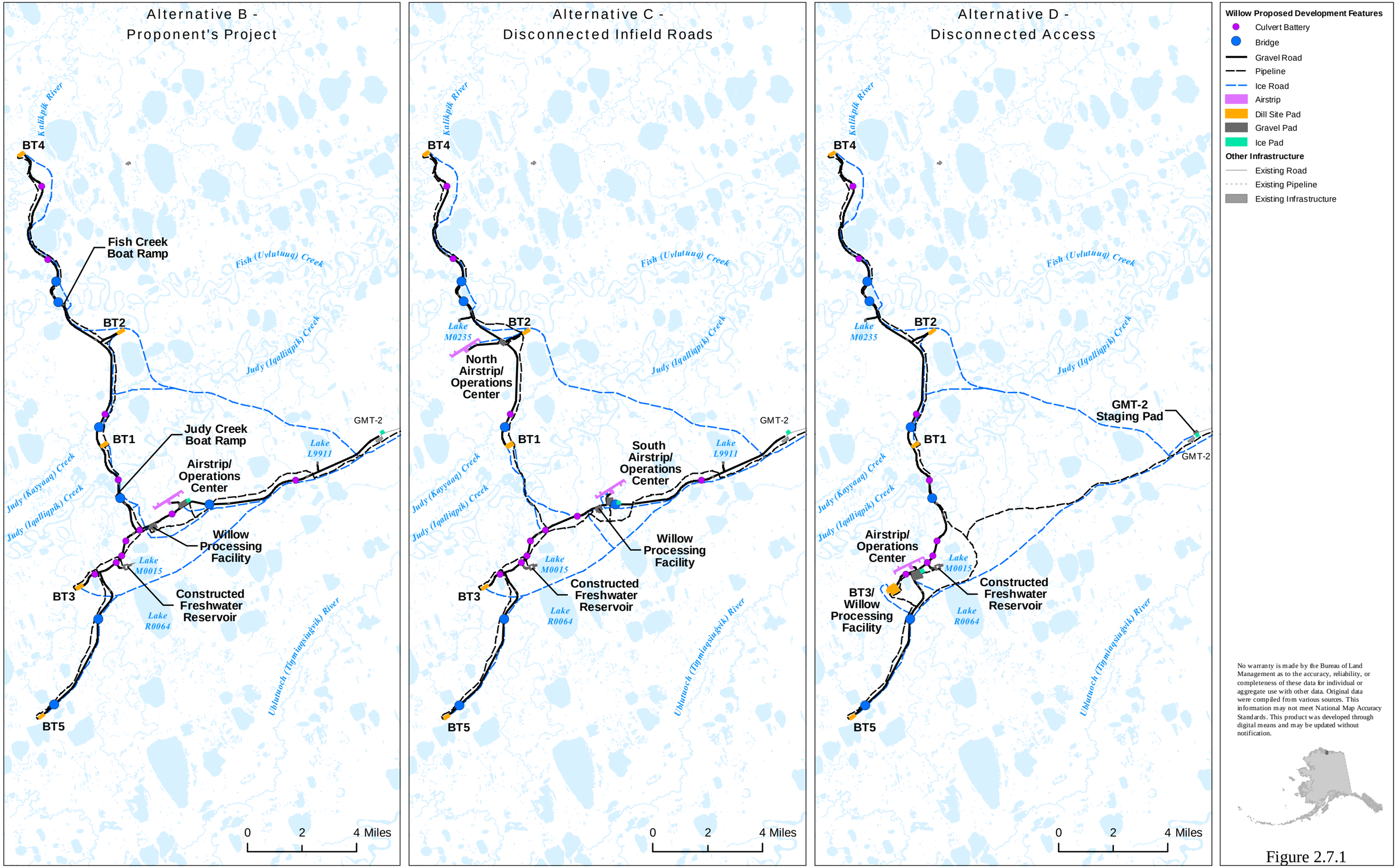

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Figure 2.7.1

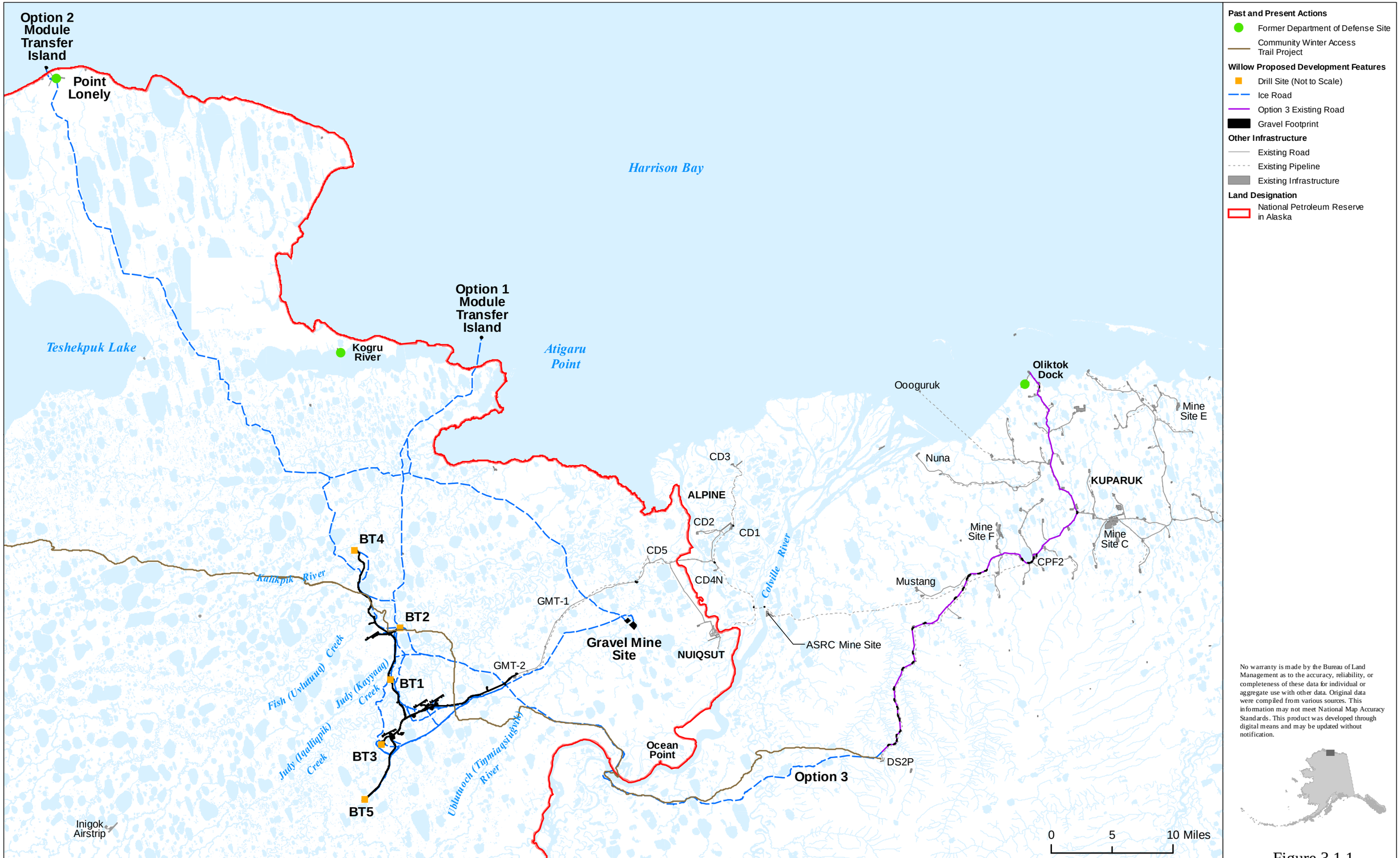

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Figure 3.1.1

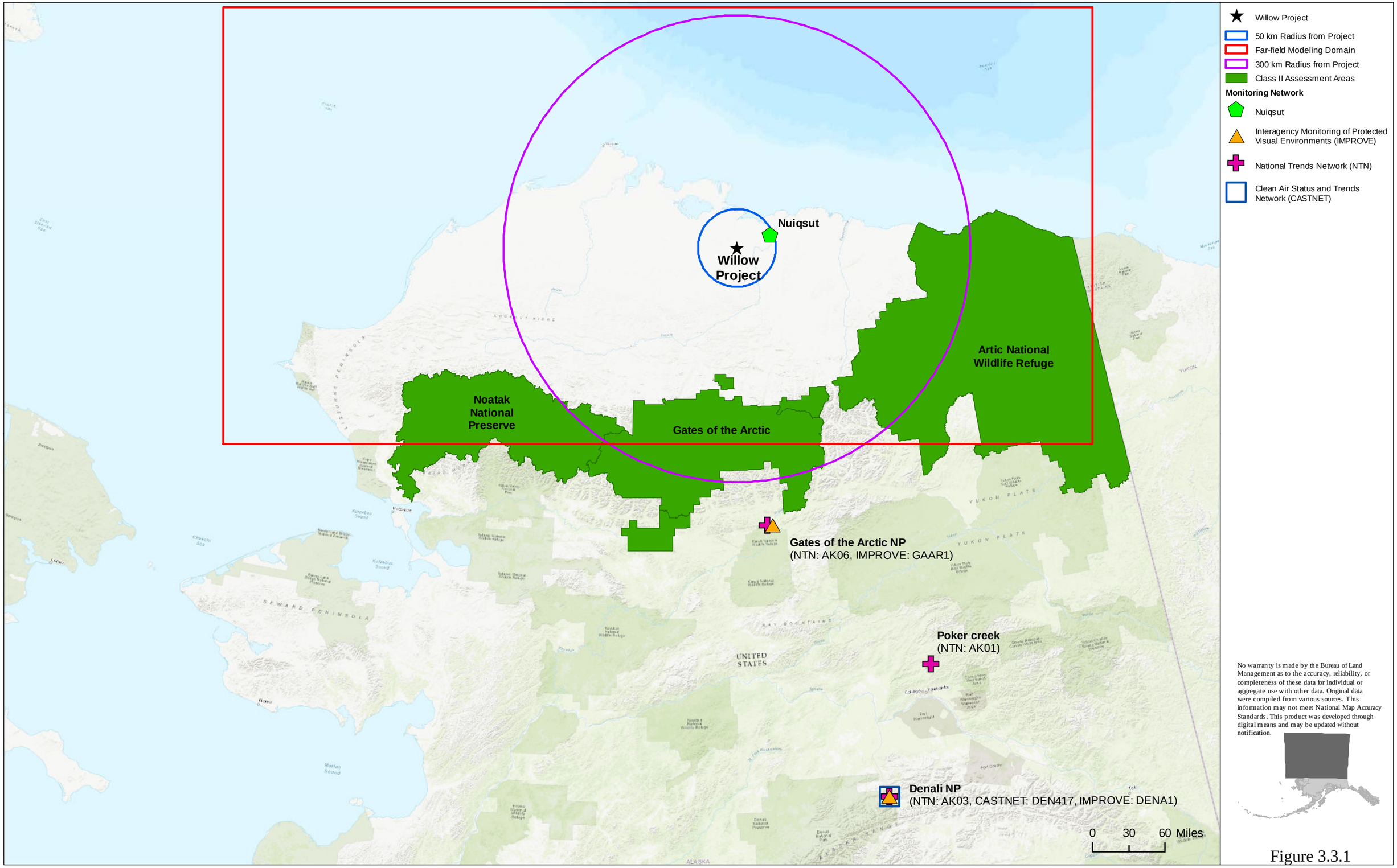
Willow Project
50 km Radius from Project
Far-field Modeling Domain
300 km Radius from Project
Class II Assessment Areas
Monitoring Network
Nuiqsut
Interagency Monitoring of Protected Visual Environments (IMPROVE)
National Trends Network (NTN)
Clean Air Status and Trends Network (CASTNET)
Nuiqsut
Willow Project
Artic National Wildlife Refuge
Noatak National Preserve
Gates of the Arctic
Gates of the Arctic NP
(NTN: AK06, IMPROVE: GAAR1)
Poker creek
(NTN: AK01)
Denali NP
(NTN: AK03, CASTNET: DEN417, IMPROVE: DENA1)
0 30 60 Miles
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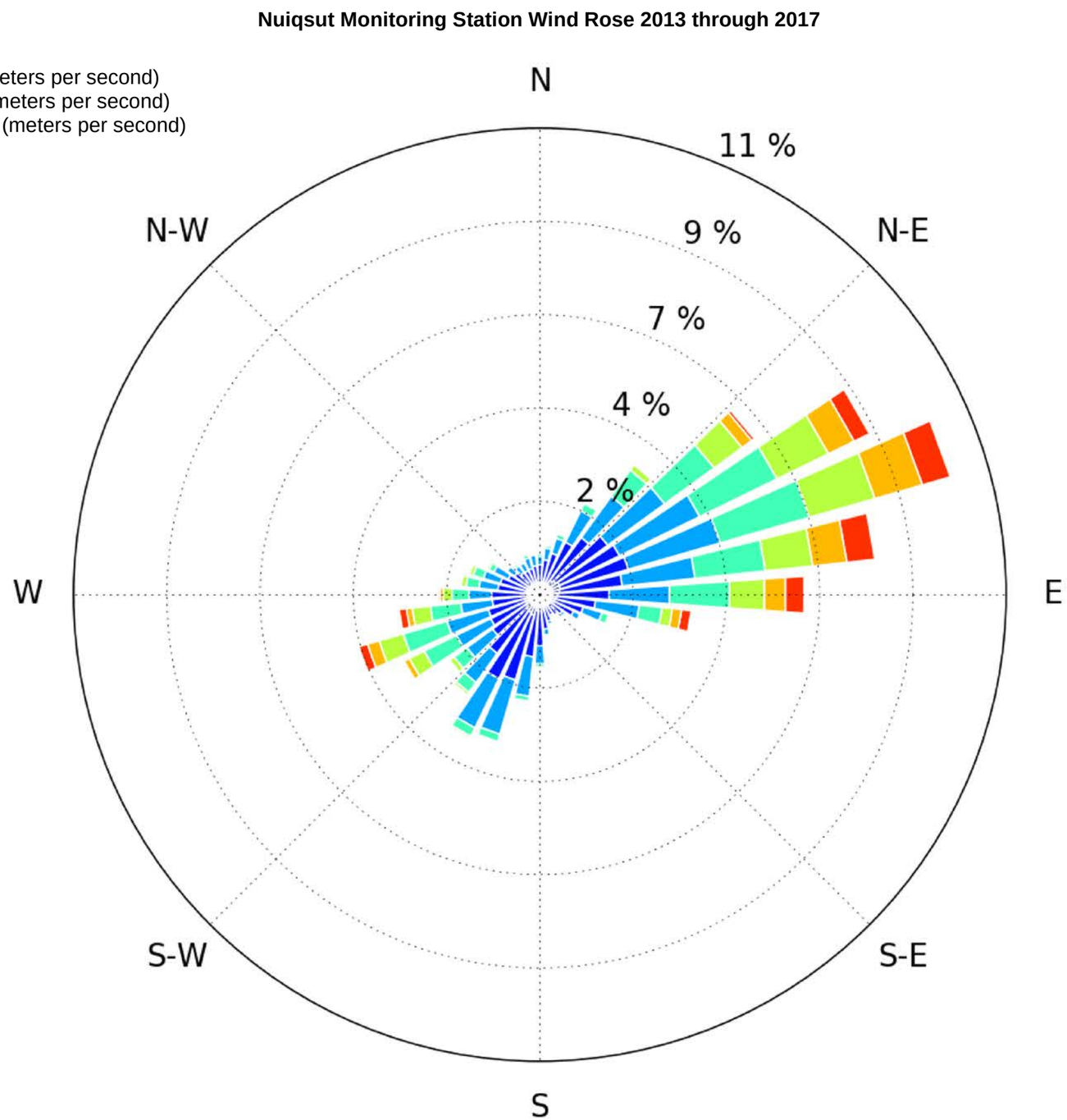
Figure 3.3.1

Wind Speed
Total Count: 43,824
Total Calm: 414
Calm: 0.9%
Missing: 1,321
Wind Speed Average: 5.0 (meters per second)
Minimum Wind Speed: 0.5 (meters per second)
Maximum Wind Speed: 22.4 (meters per second)



Wind Speed (meters per second)
- 0.5 to 2.0
- 2.0 to 4.0
- 4.0 to 6.0
- 6.0 to 8.0
- 8.0 to 10.0
- 10.0 to 12.0
- 12.0+

Figure 3.3.2

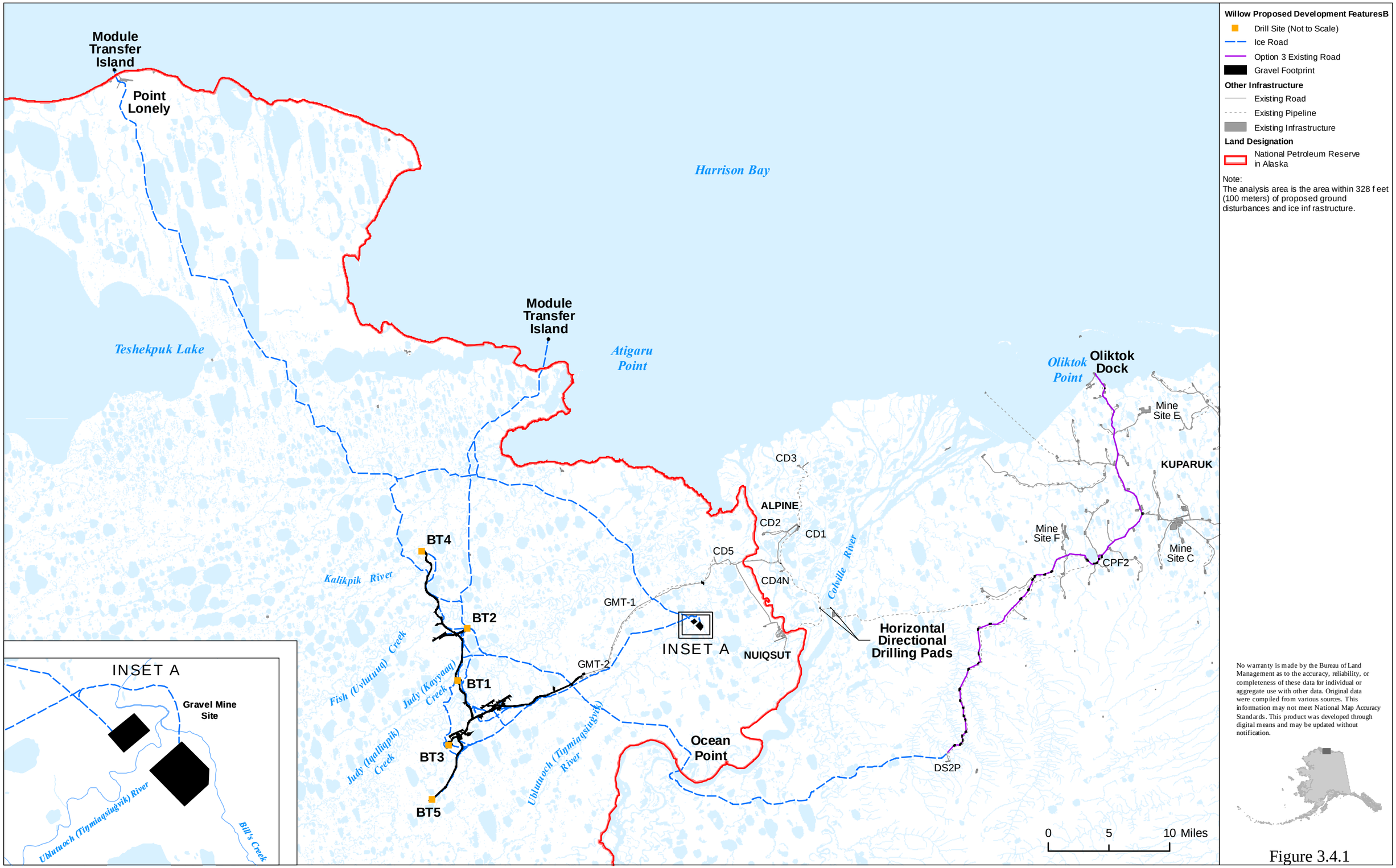

Module Transfer Island
Point Lonely
Harrison Bay
Module Transfer Island
Teshekpuk Lake
Atigaru Point
Oliktok Point
Oliktok Dock
Mine Site E
KUPARUK
CD3
ALPINE
CD2
CD1
CD5
CD4N
Colville River
Mine Site F
CPF2
Mine Site C
BT4
Kalikpik River
BT2
GMT-1
INSET A
NUIQSUT
Horizontal Directional Drilling Pads
Fish (Uvlutuuq) Creek
Judy (Kayyaaq) Creek
BT1
GMT-2
Judy (Iqulliqpik) Creek
BT3
Ublutuoch (Tiŋmiaqsiuġvik) River
Ocean Point
BT5
DS2P
0
5
10 Miles
INSET A
Gravel Mine Site
Ublutuoch (Tiŋmiaqsiuġvik) River
Bill's Creek
Willow Proposed Development FeaturesB
Drill Site (Not to Scale)
Ice Road
Option 3 Existing Road
Gravel Footprint
Other Infrastructure
Existing Road
Existing Pipeline
Existing Infrastructure
Land Designation
National Petroleum Reserve in Alaska
Note:
The analysis area is the area within 328 feet (100 meters) of proposed ground disturbances and ice infrastructure.
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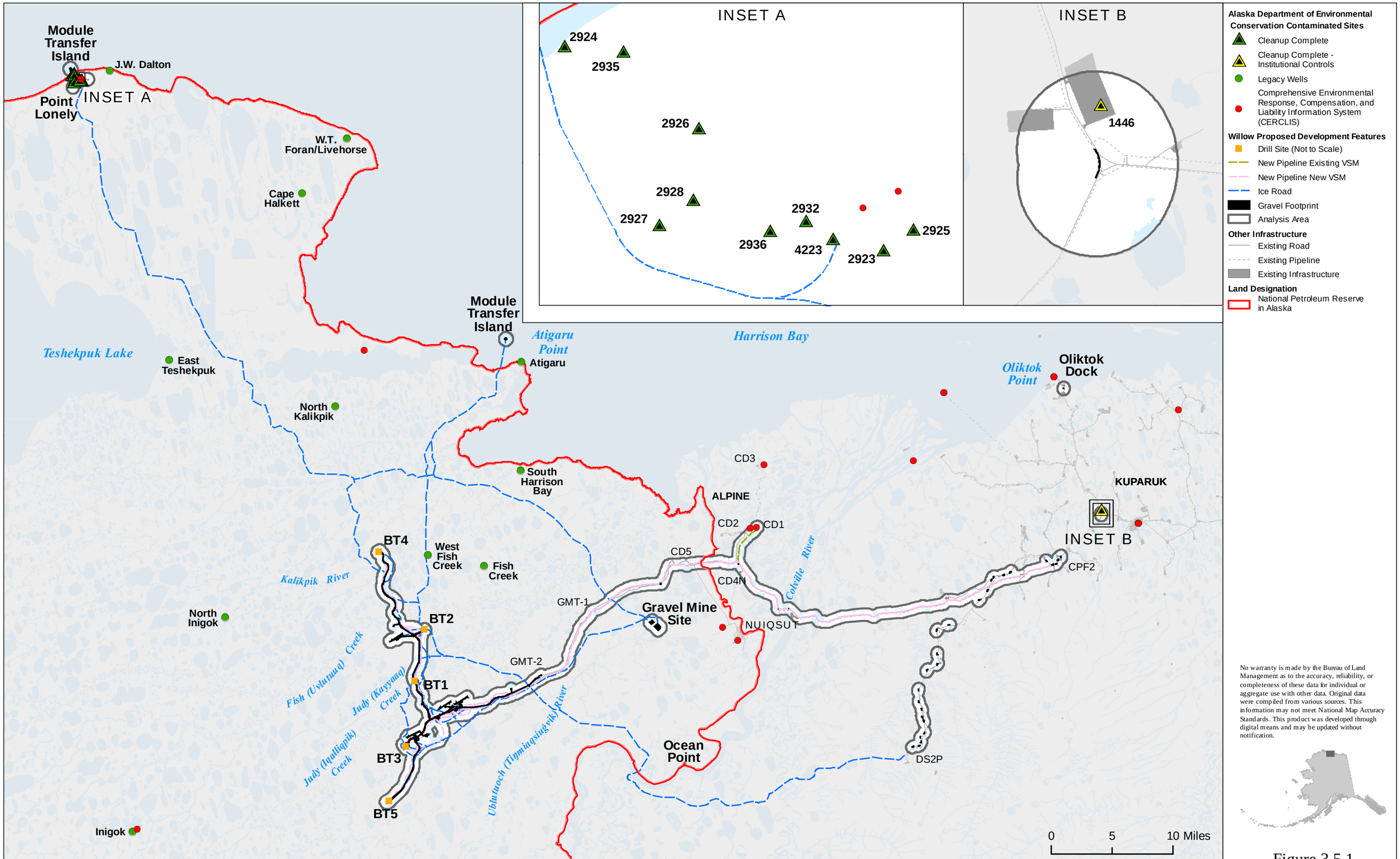
Figure 3.4.1



No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources. This information may not meet National Map Accuracy Standards. This product was developed through digital means and may be updated without notification.

Figure 3.5.1

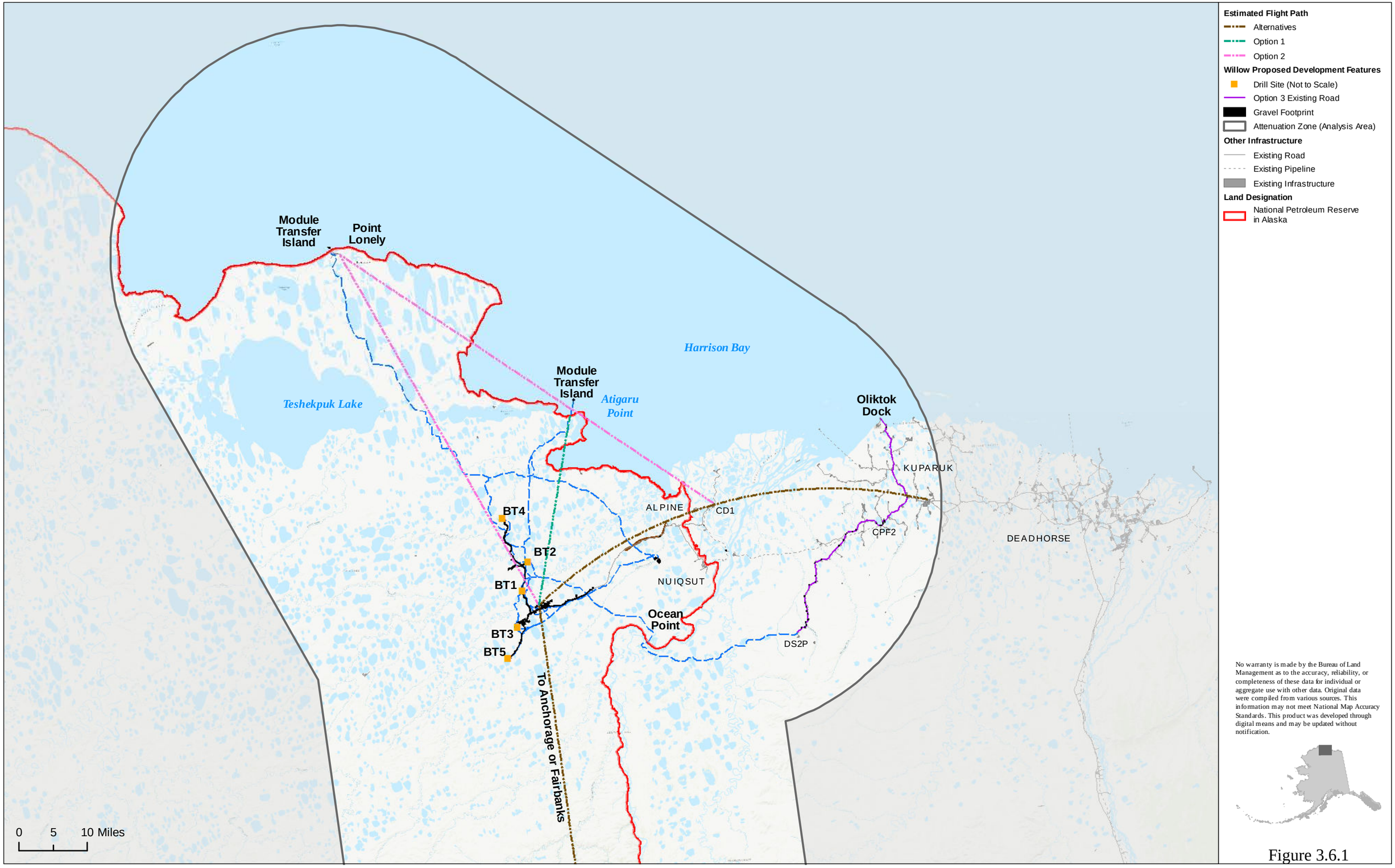
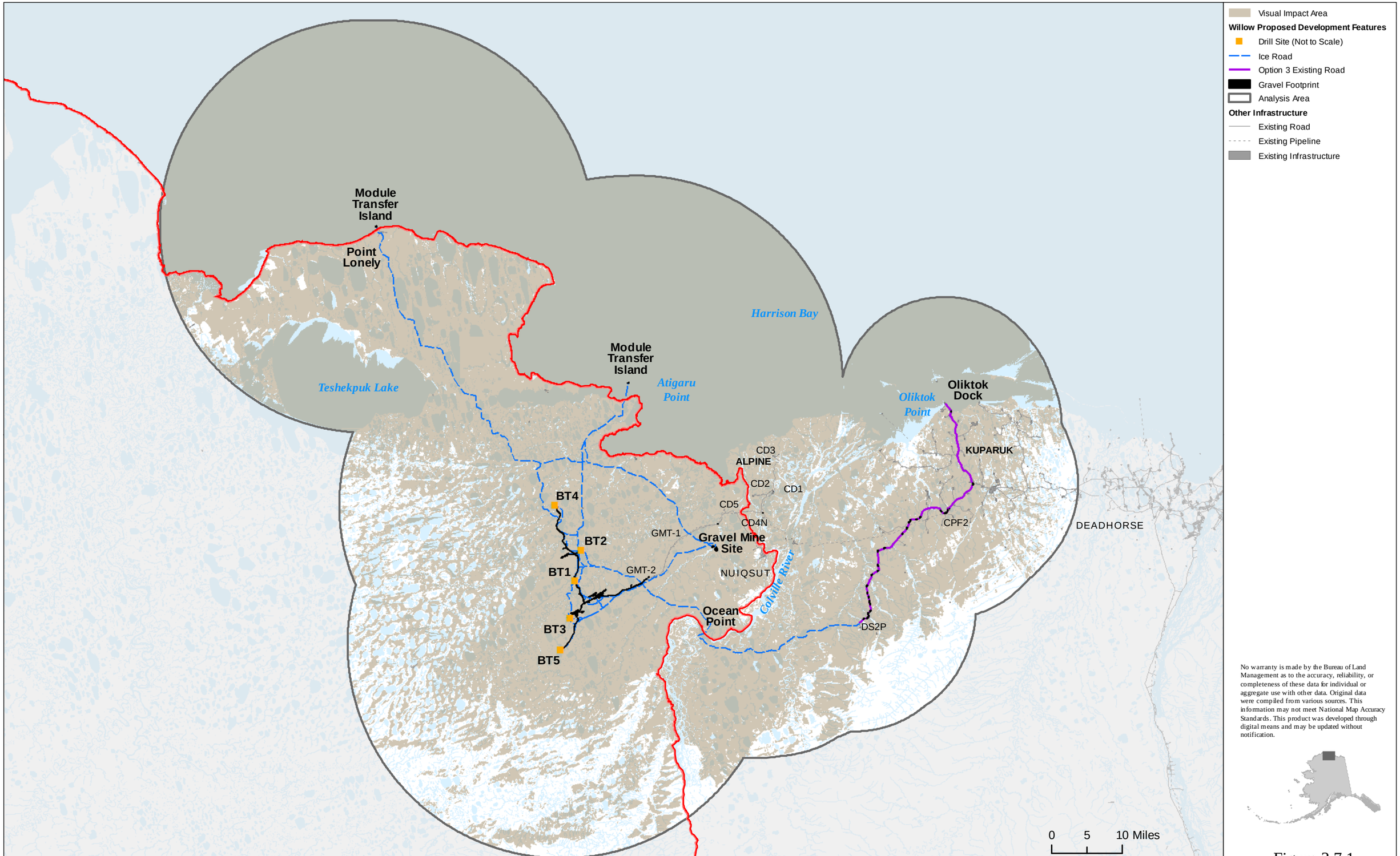
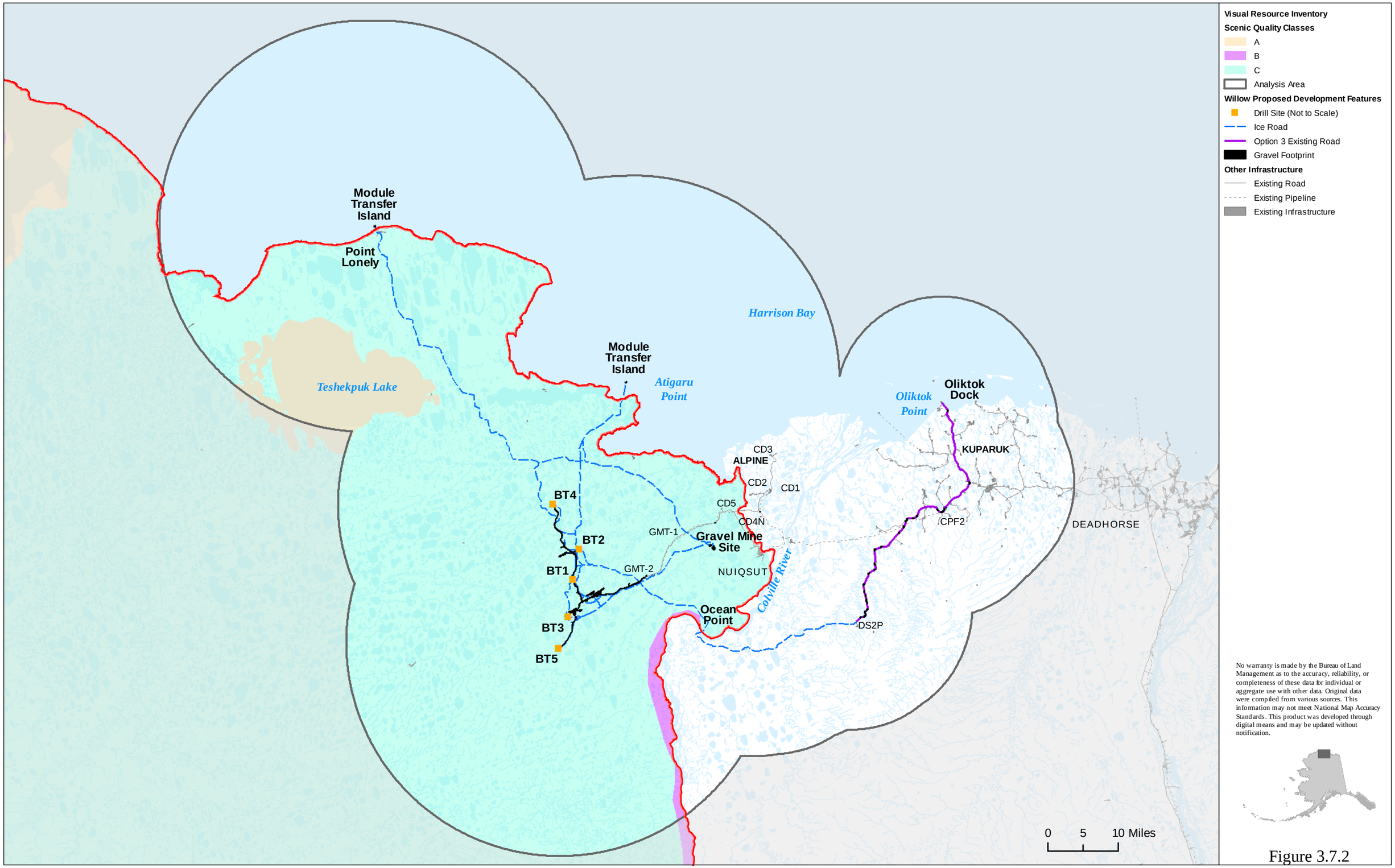

Estimated Flight Path
Alternatives
Option 1
Option 2
Willow Proposed Development Features
Drill Site (Not to Scale)
Option 3 Existing Road
Gravel Footprint
Attenuation Zone (Analysis Area)
Other Infrastructure
Existing Road
Existing Pipeline
Existing Infrastructure
Land Designation
National Petroleum Reserve in Alaska
Module Transfer Island
Point Lonely
Harrison Bay
Module Transfer Island
Atigaru Point
Teshekpuk Lake
Oliktok Dock
KUPARUK
ALPINE
CD1
CPF2
DEADHORSE
BT4
BT2
BT1
BT3
BT5
NUIQSUT
Ocean Point
DS2P
To Anchorage or Fairbanks
0 5 10 Miles
No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources. This information may not meet National Map Accuracy Standards. This product was developed through digital means and may be updated without notification.

Figure 3.6.1



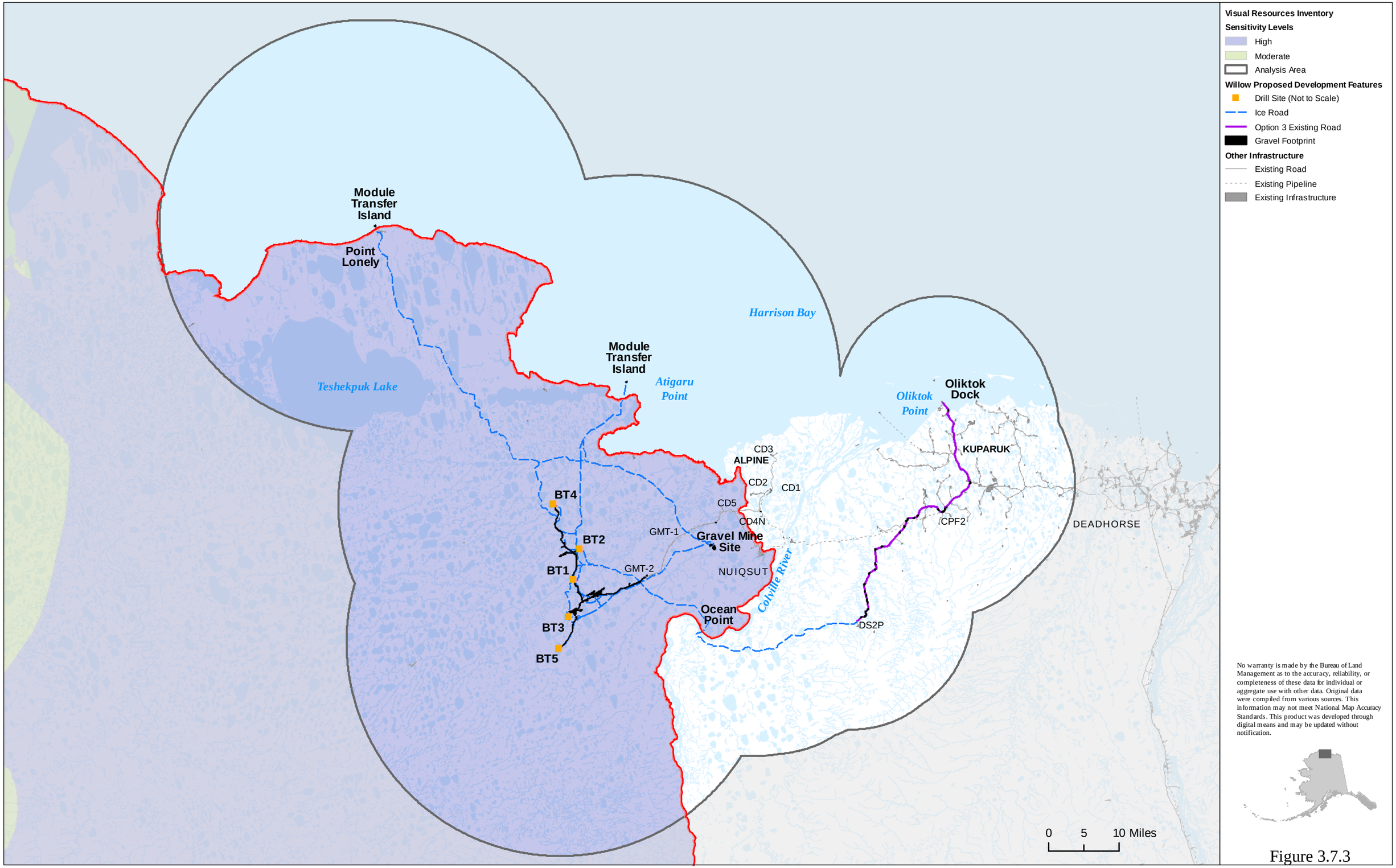
No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources. This information may not meet National Map Accuracy Standards. This product was developed through digital means and may be updated without notification.

Figure 3.7.1



No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources. This information may not meet National Map Accuracy Standards. This product was developed through digital means and may be updated without notification.

Figure 3.7.2



No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources. This information may not meet National Map Accuracy Standards. This product was developed through digital means and may be updated without notification.

Figure 3.7.3

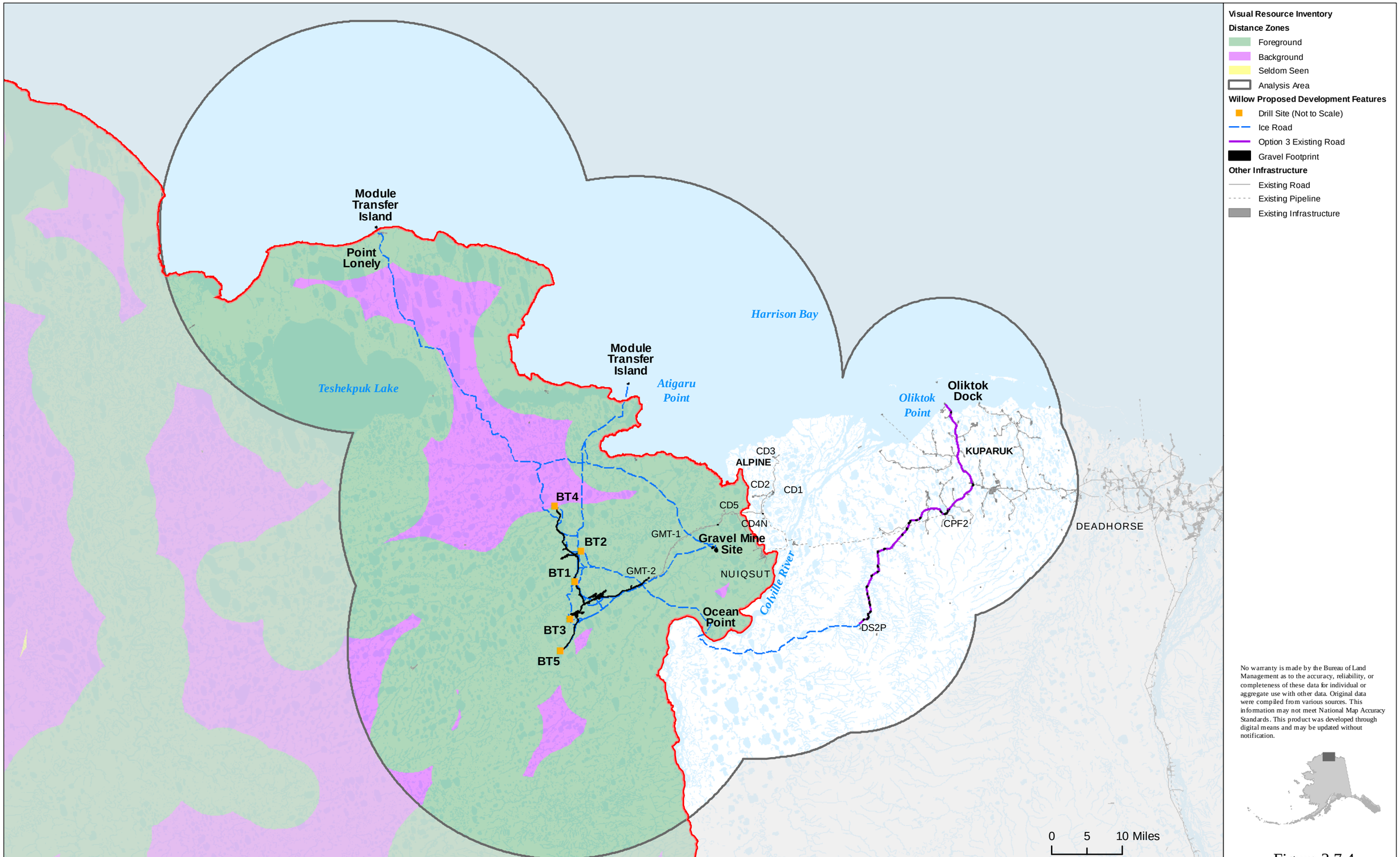
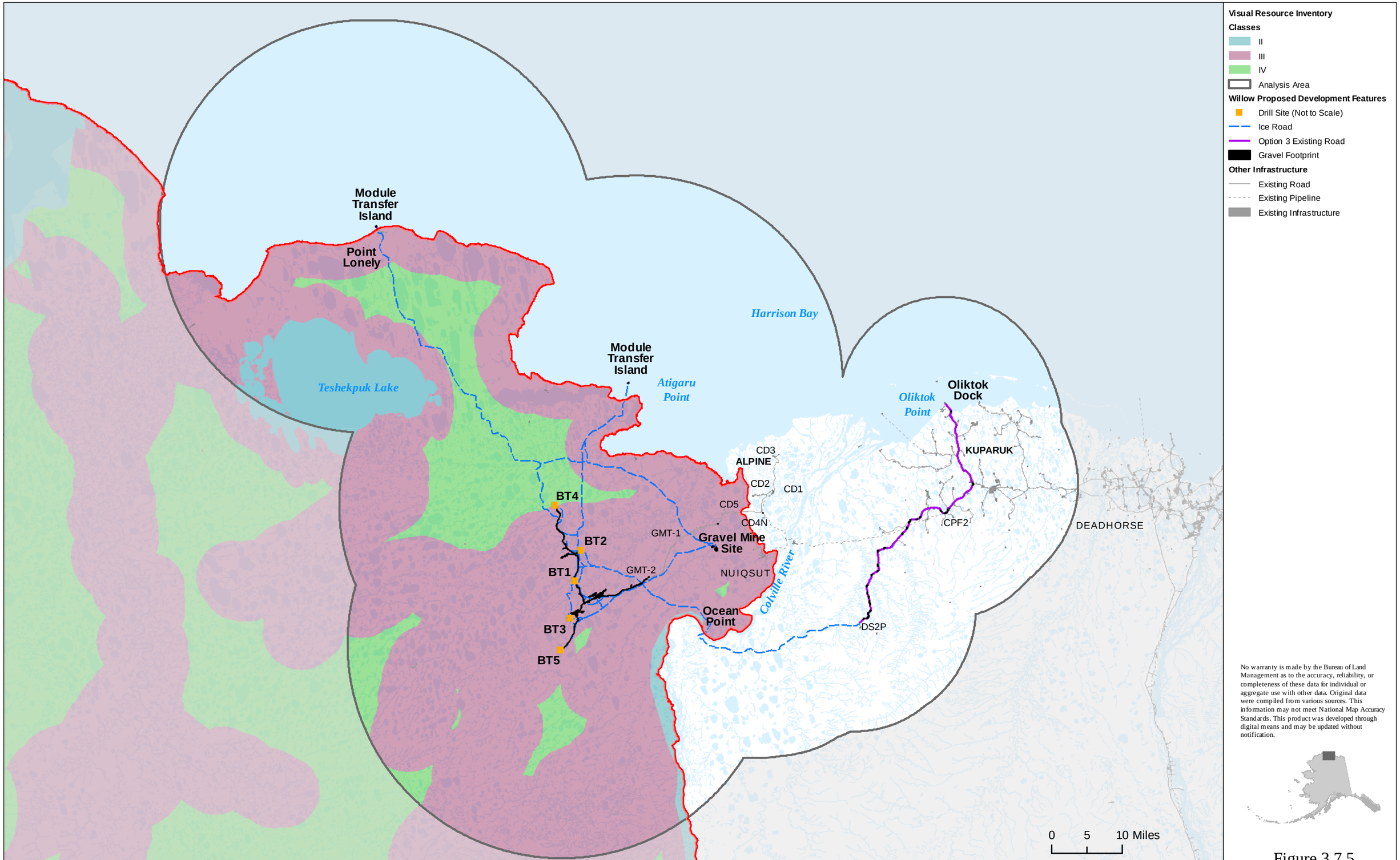
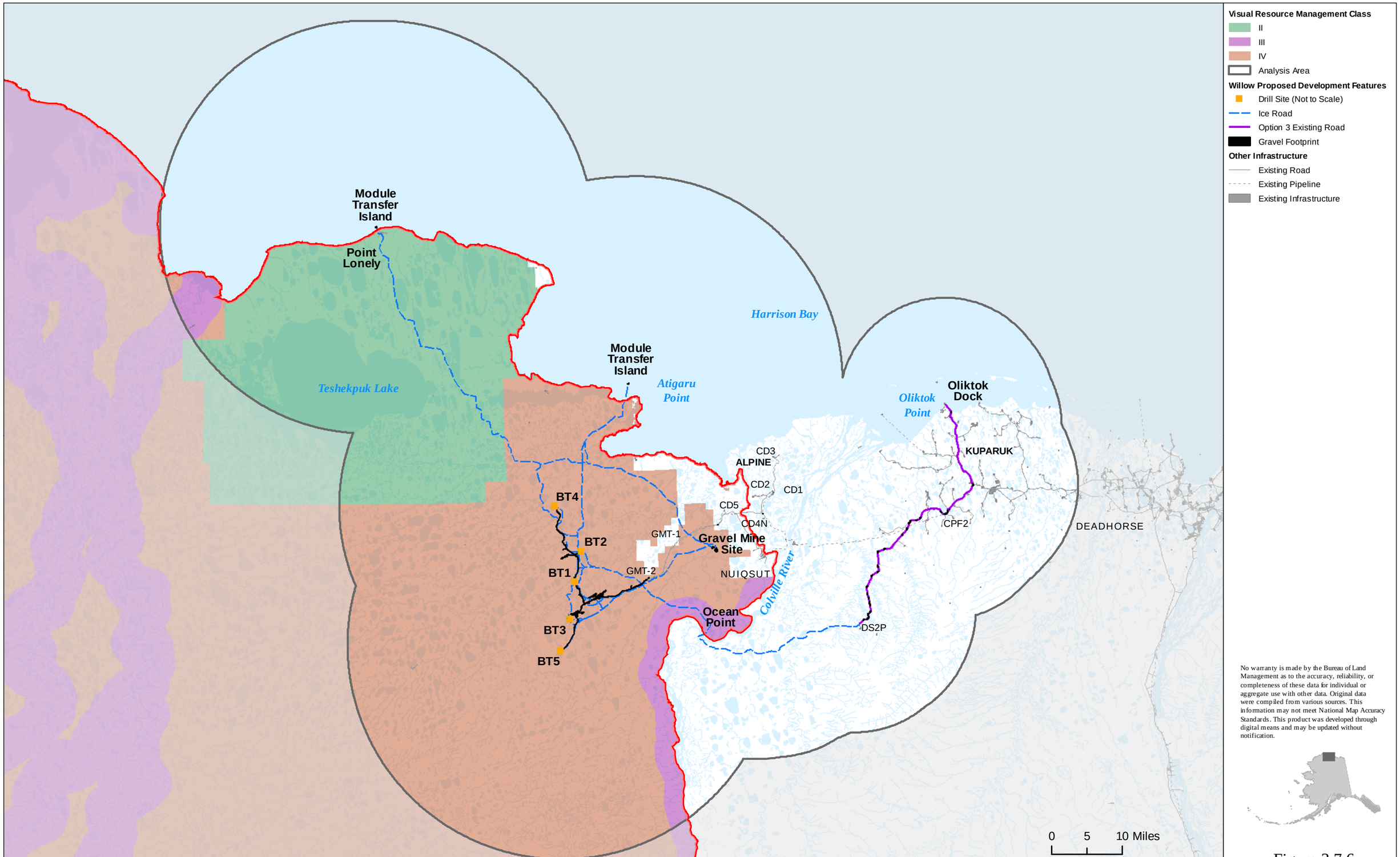

Visual Resource Inventory
Distance Zones
Foreground
Background
Seldom Seen
Analysis Area
Willow Proposed Development Features
Drill Site (Not to Scale)
Ice Road
Option 3 Existing Road
Gravel Footprint
Other Infrastructure
Existing Road
Existing Pipeline
Existing Infrastructure
Module Transfer Island
Point Lonely
Harrison Bay
Module Transfer Island
Atigaru Point
Teshekpuk Lake
Oliktok Point
Oliktok Dock
KUPARUK
CD3
ALPINE
CD2
CD1
CD5
CD4N
BT4
BT2
BT1
BT3
BT5
GMT-1
GMT-2
Gravel Mine Site
NUIQSUT
Colville River
Ocean Point
CPF2
DS2P
DEADHORSE
0 5 10 Miles
No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources. This information may not meet National Map Accuracy Standards. This product was developed through digital means and may be updated without notification.

Figure 3.7.4



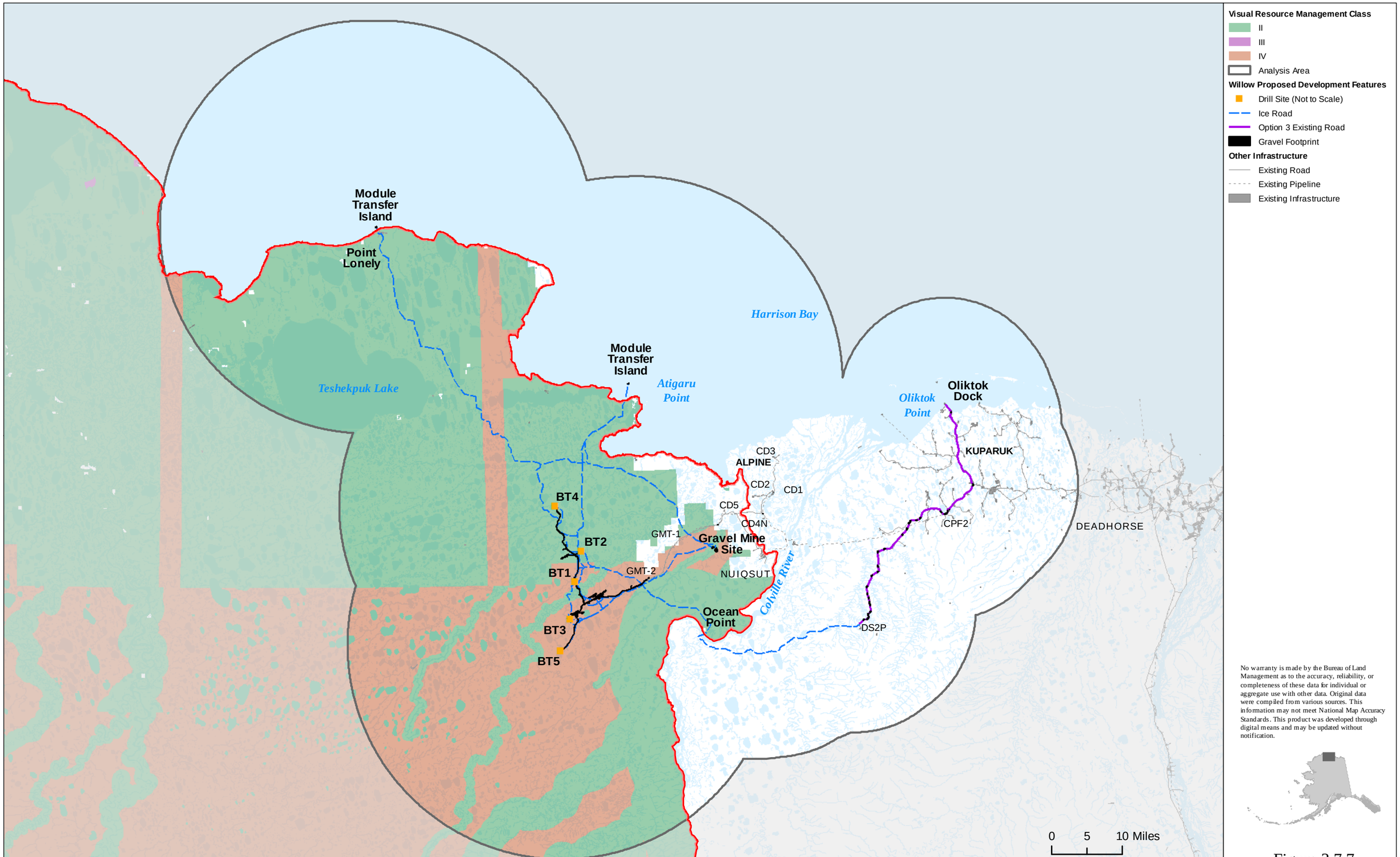
No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources. This information may not meet National Map Accuracy Standards. This product was developed through digital means and may be updated without notification.

Figure 3.7.5



No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources. This information may not meet National Map Accuracy Standards. This product was developed through digital means and may be updated without notification.

Figure 3.7.6



No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources. This information may not meet National Map Accuracy Standards. This product was developed through digital means and may be updated without notification.

Figure 3.7.7

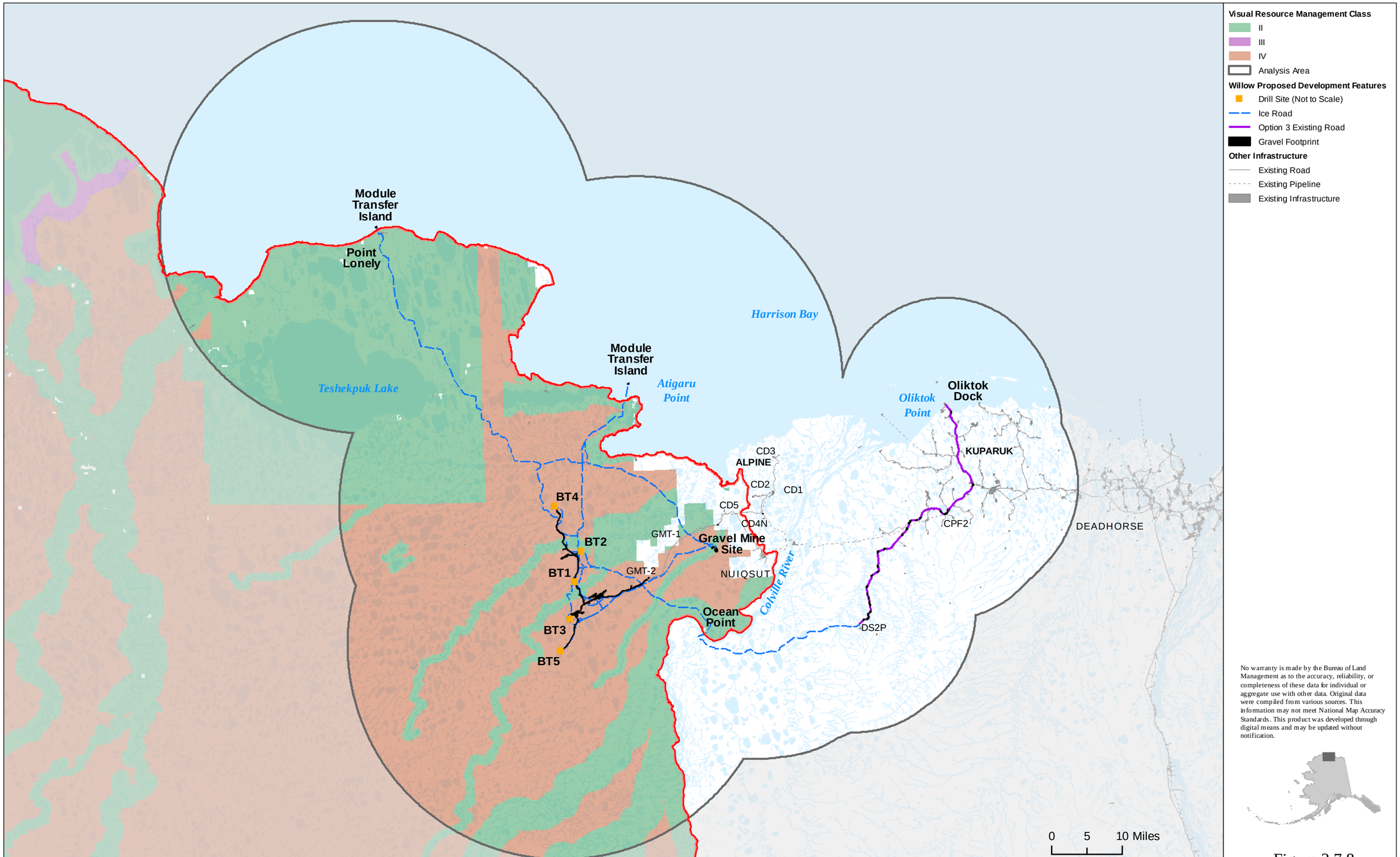


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Figure 3.7.8

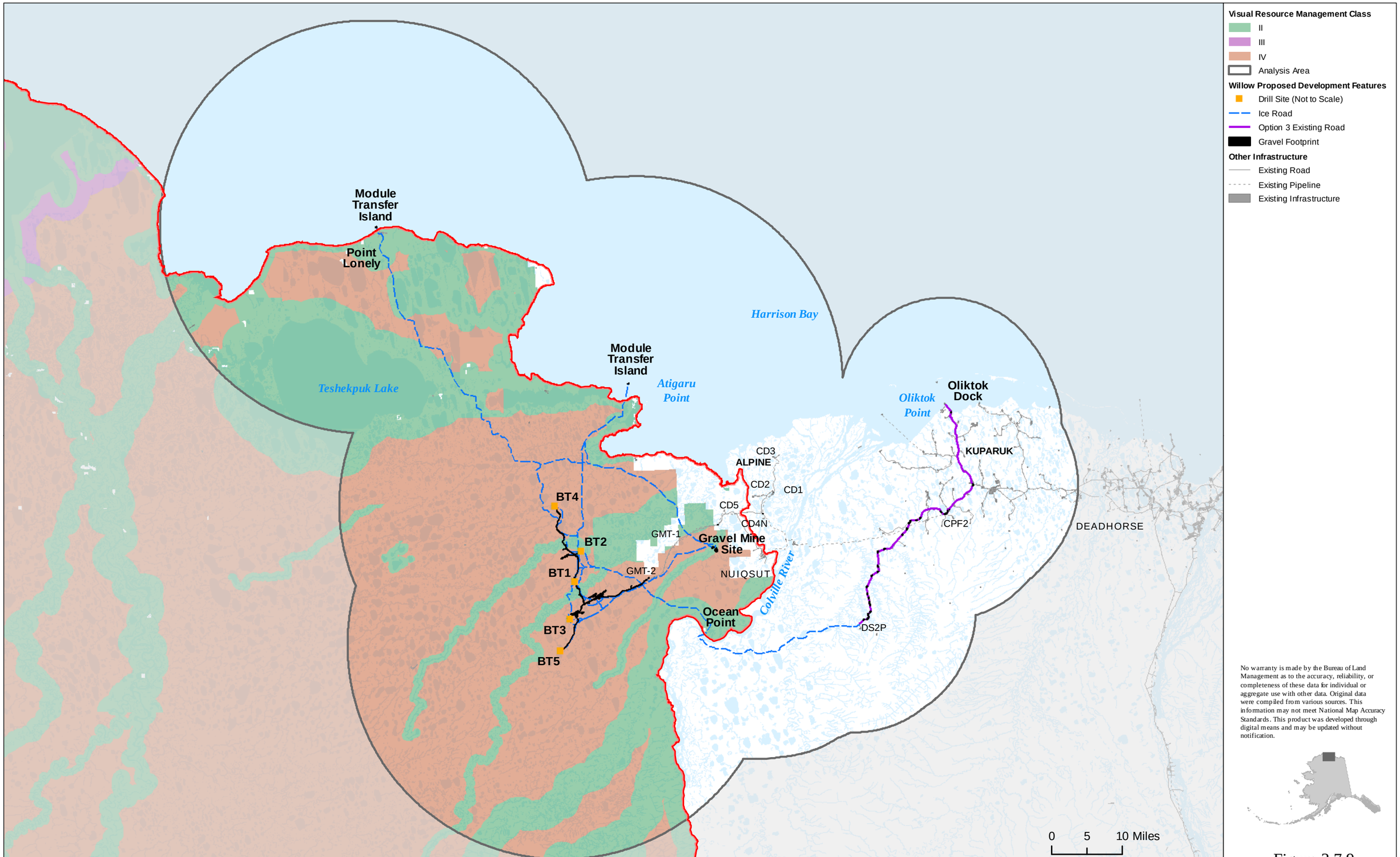

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Figure 3.7.9

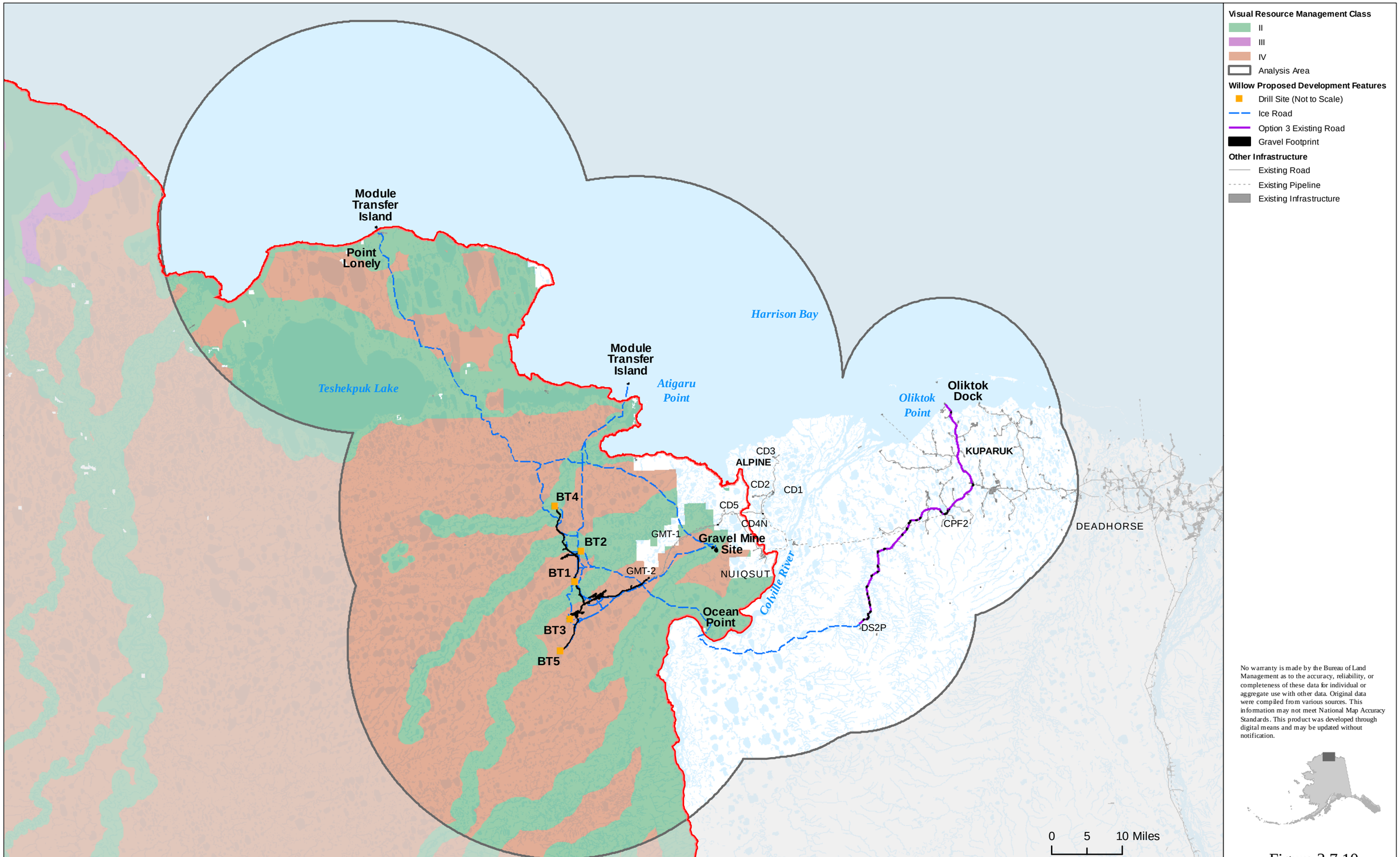

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Figure 3.7.10

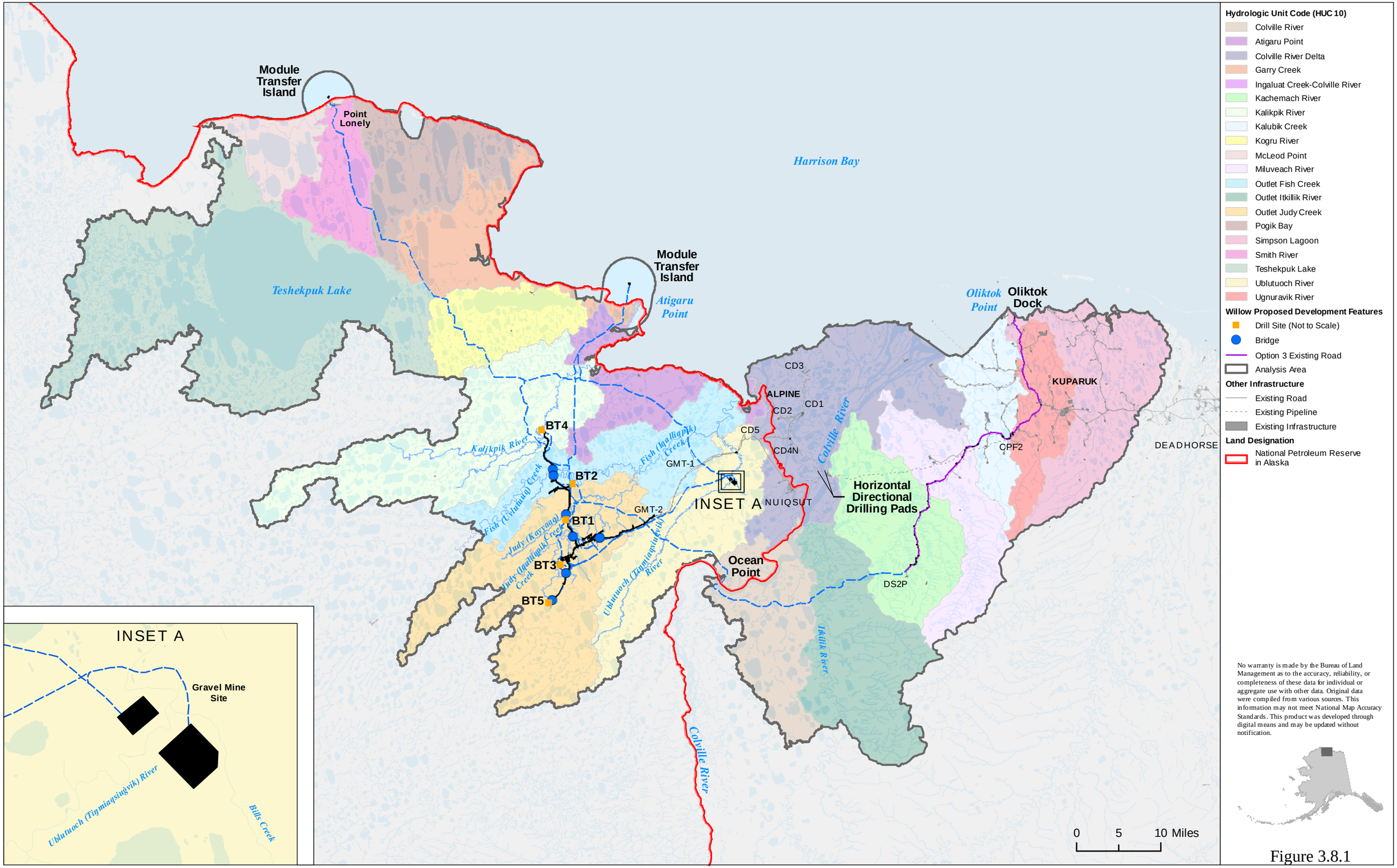
Module Transfer Island
Point Lonely
Harrison Bay
Teshekpuk Lake
Module Transfer Island
Atigaru Point
Oliktok Point
Oliktok Dock
KUPARUK
CD3
ALPINE
CD1
CD2
CD5
CD4N
Colville River
CPF2
DEADHORSE
BT4
Kalikpik River
Fish (Iqalliqpik) Creek
GMT-1
BT2
Fish (Uvlutuoq) Creek
GMT-2
INSET A
NUIQSUT
Horizontal Directional Drilling Pads
BT1
Judy (Kayyaaq) Creek
Judy (Iqalliqpik) Creek
BT3
Ublutuoch (Tinmiaqsiugvik) River
Ocean Point
DS2P
BT5
Iikillik River
Colville River
INSET A
Gravel Mine Site
Ublutuoch (Tinmiaqsiugvik) River
Bills Creek
0 5 10 Miles
Hydrologic Unit Code (HUC 10)
Colville River
Atigaru Point
Colville River Delta
Garry Creek
Ingaluat Creek-Colville River
Kachemach River
Kalikpik River
Kalubik Creek
Kogru River
McLeod Point
Miluveach River
Outlet Fish Creek
Outlet Itkillik River
Outlet Judy Creek
Pogik Bay
Simpson Lagoon
Smith River
Teshekpuk Lake
Ublutuoch River
Ugnuravik River
Willow Proposed Development Features
Drill Site (Not to Scale)
Bridge
Option 3 Existing Road
Analysis Area
Other Infrastructure
Existing Road
Existing Pipeline
Existing Infrastructure
Land Designation
National Petroleum Reserve in Alaska
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Figure 3.8.1

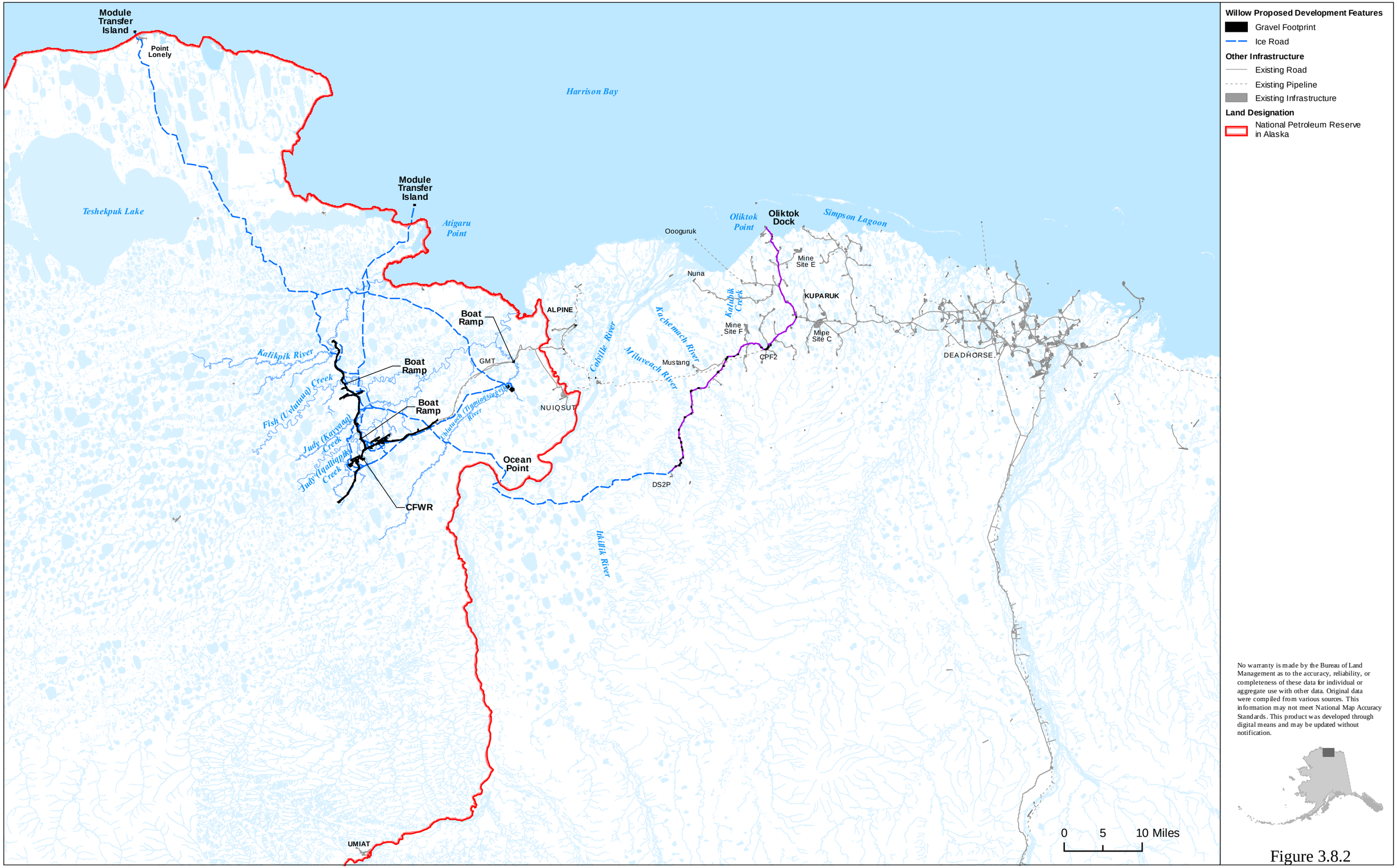

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Figure 3.8.2

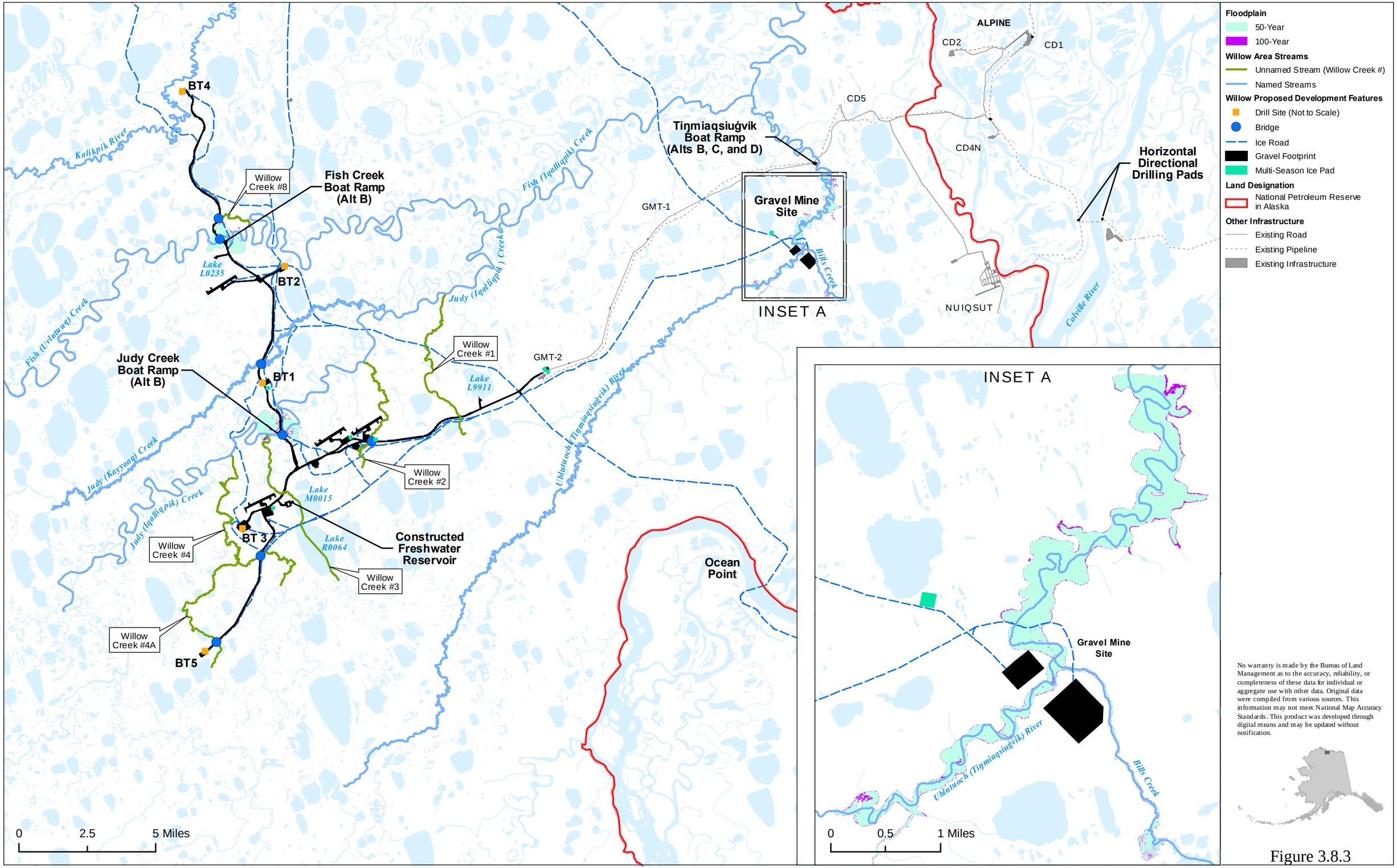

BT4
Kalikpik River
Willow Creek #8
Fish Creek Boat Ramp (Alt B)
Lake L0235
BT2
Fish (Uvlutuuq) Creek
Judy Creek Boat Ramp (Alt B)
BT1
Judy (Iqaliqpik) Creek
Fish (Iqaliqpik) Creek
Tinmiaqsiuġvik Boat Ramp (Alts B, C, and D)
GMT-1
Gravel Mine Site
Bills Creek
INSET A
CD5
CD2
ALPINE
CD1
CD4N
NUIQSUT
Horizontal Directional Drilling Pads
Colville River
Willow Creek #1
GMT-2
Lake L9911
Ublutuoch (Tinmiaqsiuġvik) River
Judy (Kayyaaq) Creek
Willow Creek #2
Lake M0015
Willow Creek #4
BT 3
Lake R0064
Constructed Freshwater Reservoir
Willow Creek #3
Ocean Point
Willow Creek #4A
BT5
0 2.5 5 Miles
INSET A
Gravel Mine Site
Ublutuoch (Tinmiaqsiuġvik) River
Bills Creek
0 0.5 1 Miles
Floodplain
50-Year
100-Year
Willow Area Streams
Unnamed Stream (Willow Creek #)
Named Streams
Willow Proposed Development Features
Drill Site (Not to Scale)
Bridge
Ice Road
Gravel Footprint
Multi-Season Ice Pad
Land Designation
National Petroleum Reserve in Alaska
Other Infrastructure
Existing Road
Existing Pipeline
Existing Infrastructure
No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources. This information may not meet National Map Accuracy Standards. This product was developed through digital means and may be updated without notification.

Figure 3.8.3

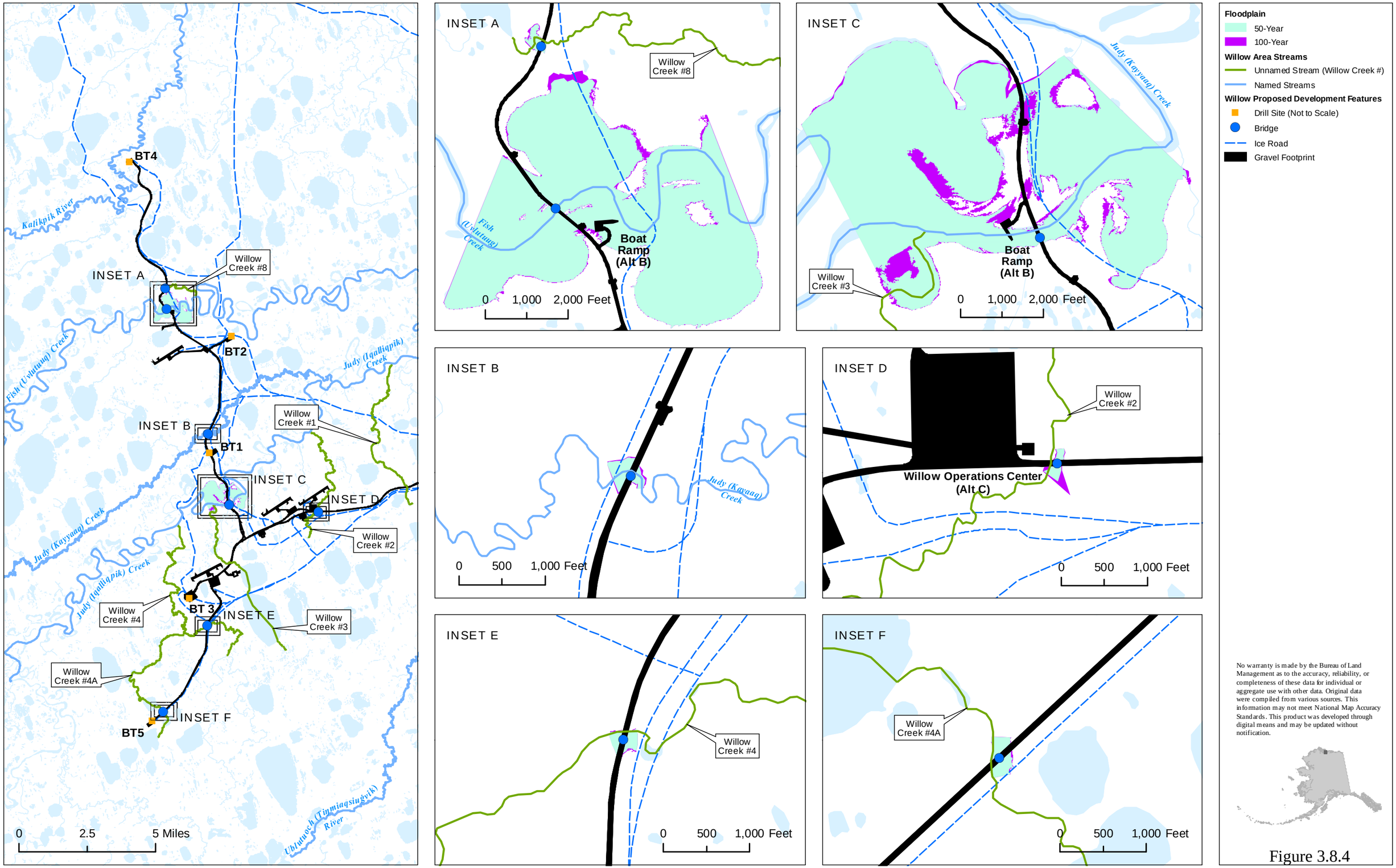
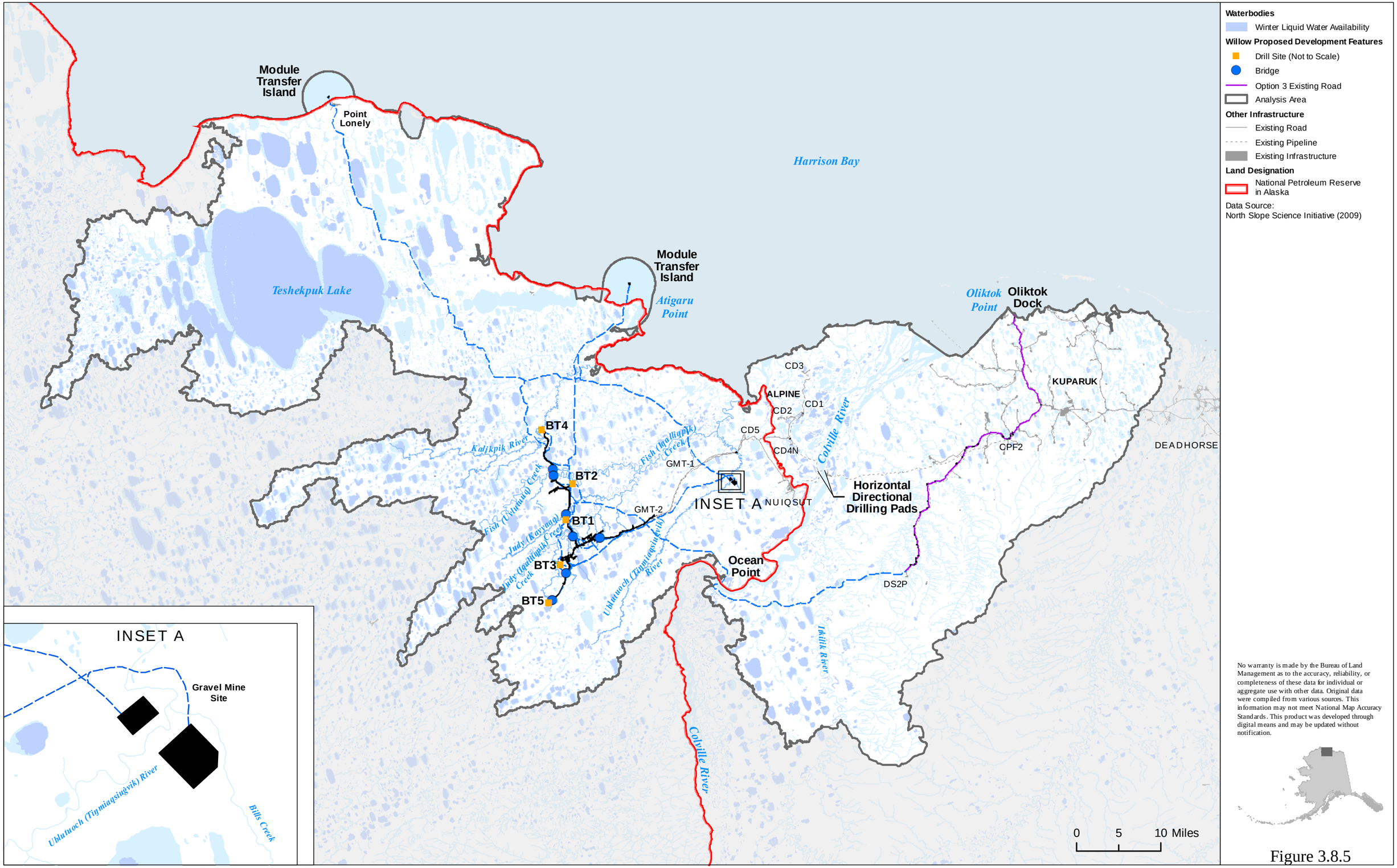

BT4
Kalikpik River
INSET A
Willow Creek #8
BT2
Fish (Uvlutuuq) Creek
Judy (Iqaliqpik) Creek
INSET B
BT1
Willow Creek #1
INSET C
INSET D
Willow Creek #2
Judy (Kayyaaq) Creek
Judy (Iqaliqpik) Creek
Willow Creek #4
BT 3
INSET E
Willow Creek #3
Willow Creek #4A
INSET F
BT5
0 2.5 5 Miles
Ublutuoch (Timmiaqsiugvik) River
INSET A
Willow Creek #8
Fish (Uvlutuuq) Creek
Boat Ramp (Alt B)
0 1,000 2,000 Feet
INSET C
Judy (Kayyaaq) Creek
Boat Ramp (Alt B)
Willow Creek #3
0 1,000 2,000 Feet
INSET B
Judy (Kayaaq) Creek
0 500 1,000 Feet
INSET D
Willow Creek #2
Willow Operations Center (Alt C)
0 500 1,000 Feet
INSET E
Willow Creek #4
0 500 1,000 Feet
INSET F
Willow Creek #4A
0 500 1,000 Feet
Floodplain
50-Year
100-Year
Willow Area Streams
Unnamed Stream (Willow Creek #)
Named Streams
Willow Proposed Development Features
Drill Site (Not to Scale)
Bridge
Ice Road
Gravel Footprint
No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources. This information may not meet National Map Accuracy Standards. This product was developed through digital means and may be updated without notification.

Figure 3.8.4



No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources. This information may not meet National Map Accuracy Standards. This product was developed through digital means and may be updated without notification.

Figure 3.8.5

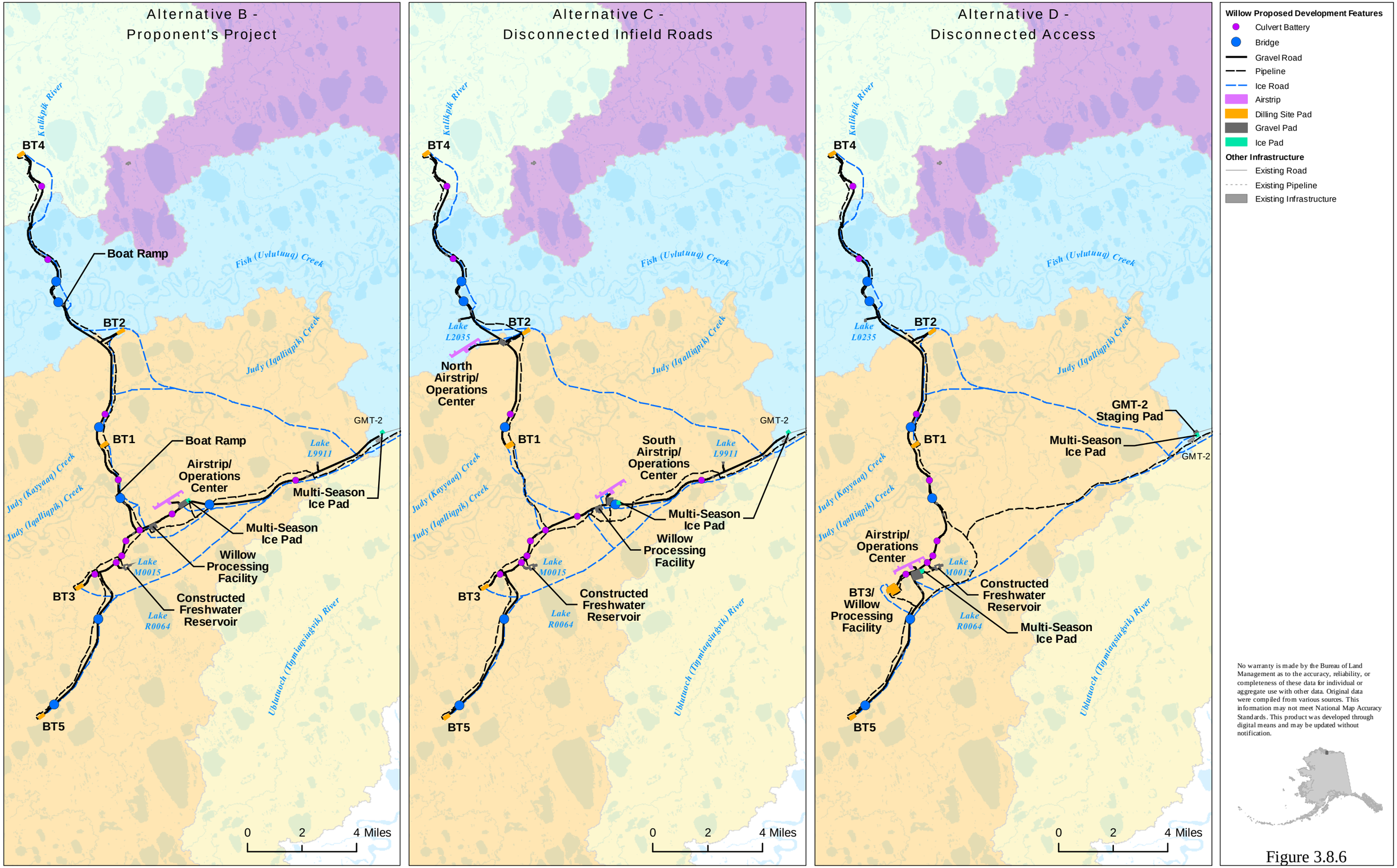

Alternative B - Proponent's Project
Alternative C - Disconnected Infield Roads
Alternative D - Disconnected Access
Kalikpik River
Fish (Uvlutuuq) Creek
Judy (Iqalliqpik) Creek
Judy (Kayyaaq) Creek
Ublutuoch (Tigmiaqsiugvik) River
BT1
BT2
BT3
BT4
BT5
Boat Ramp
Airstrip/ Operations Center
North Airstrip/ Operations Center
South Airstrip/ Operations Center
Multi-Season Ice Pad
Willow Processing Facility
Constructed Freshwater Reservoir
BT3/ Willow Processing Facility
GMT-2
GMT-2 Staging Pad
Lake L2035
Lake L0235
Lake L9911
Lake M0015
Lake R0064
0 2 4 Miles
Willow Proposed Development Features
Culvert Battery
Bridge
Gravel Road
Pipeline
Ice Road
Airstrip
Dilling Site Pad
Gravel Pad
Ice Pad
Other Infrastructure
Existing Road
Existing Pipeline
Existing Infrastructure
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Figure 3.8.6

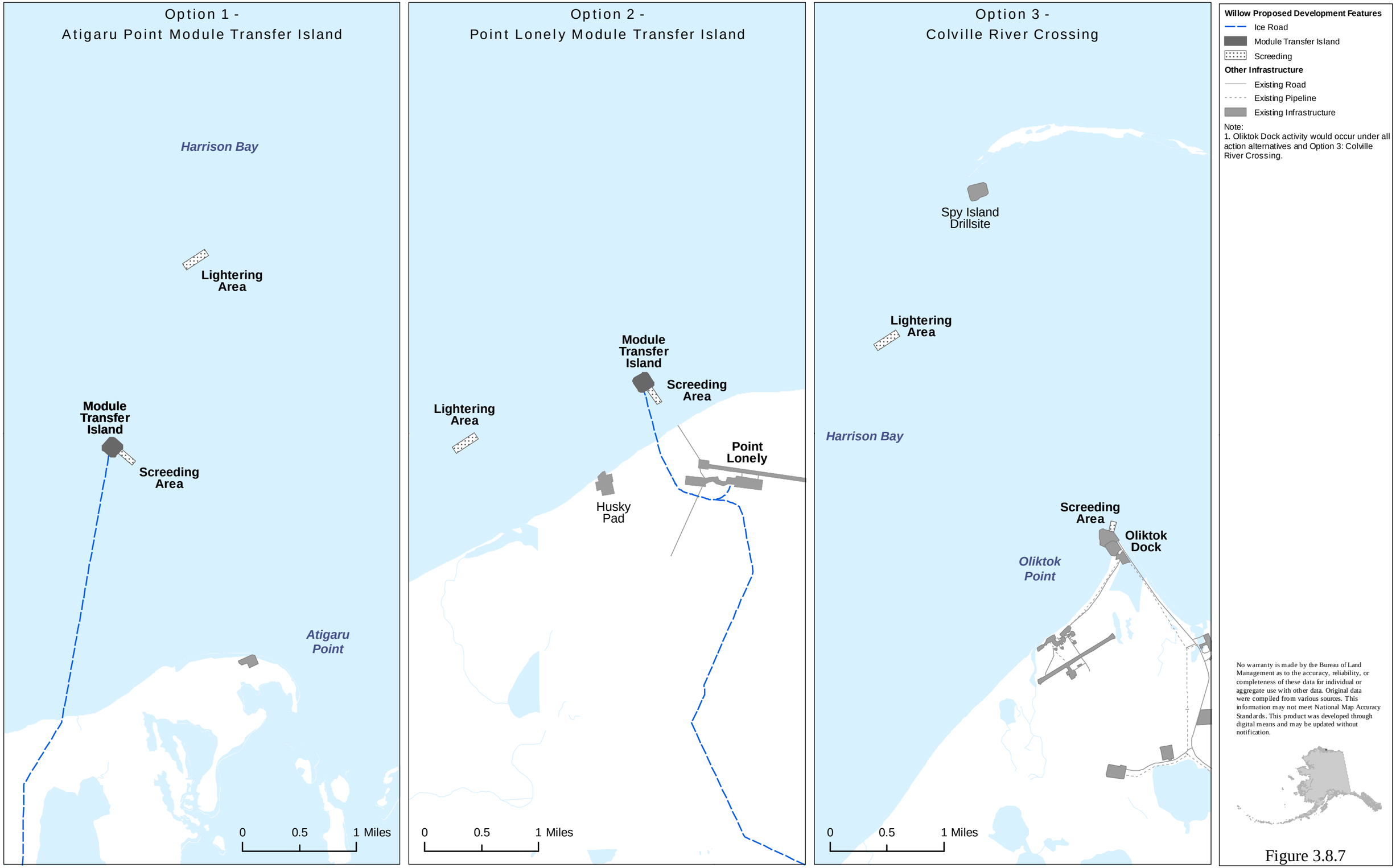
Option 1 -
Atigaru Point Module Transfer Island
Harrison Bay
Lightering Area
Module Transfer Island
Screeding Area
Atigaru Point
0 0.5 1 Miles
Option 2 -
Point Lonely Module Transfer Island
Module Transfer Island
Screeding Area
Lightering Area
Point Lonely
Husky Pad
0 0.5 1 Miles
Option 3 -
Colville River Crossing
Spy Island Drillsite
Lightering Area
Harrison Bay
Screeding Area
Oliktok Dock
Oliktok Point
0 0.5 1 Miles
Willow Proposed Development Features
Ice Road
Module Transfer Island
Screeding
Other Infrastructure
Existing Road
Existing Pipeline
Existing Infrastructure
Note:
1. Oliktok Dock activity would occur under all action alternatives and Option 3: Colville River Crossing.
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Figure 3.8.7

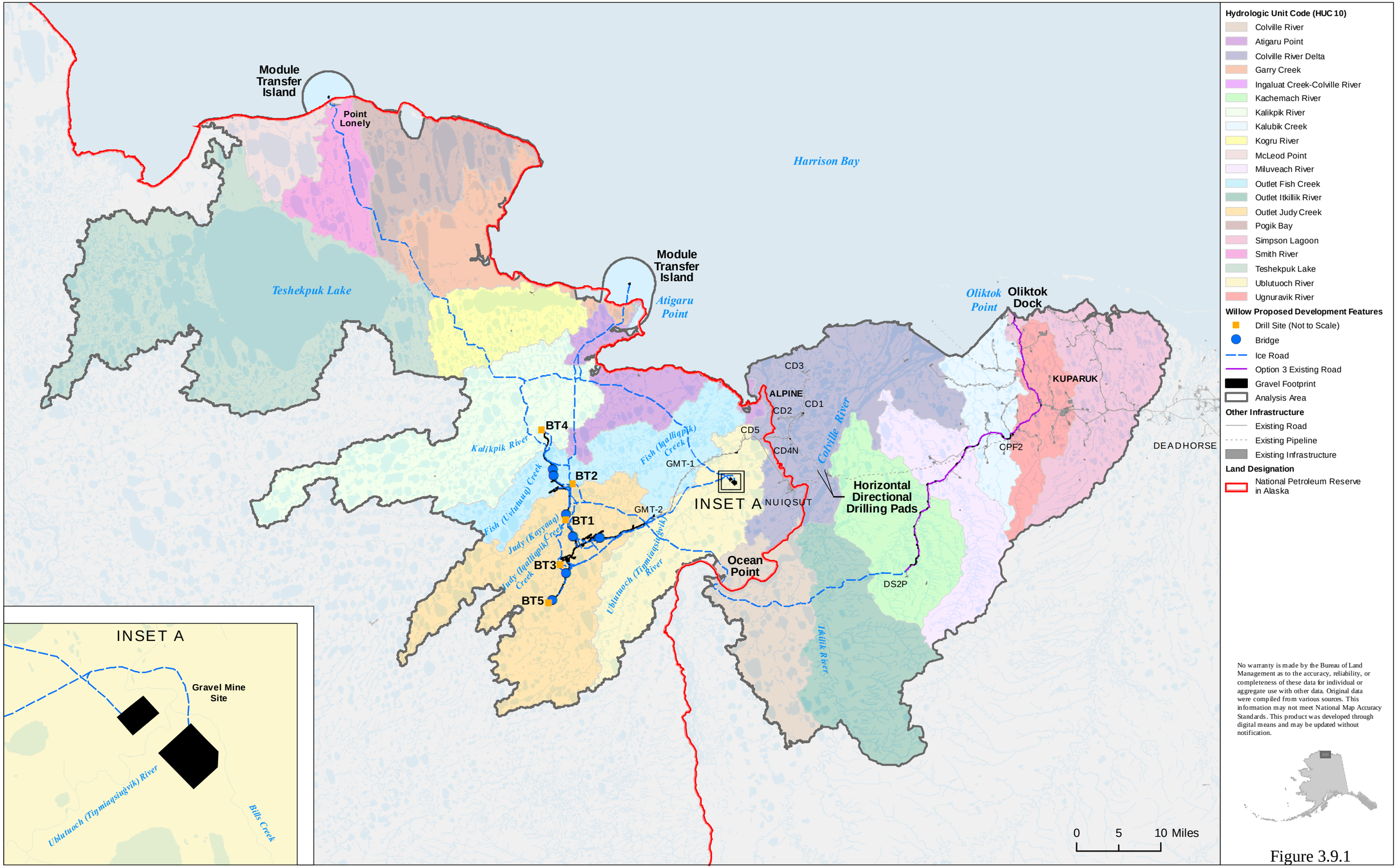
Module Transfer Island
Point Lonely
Harrison Bay
Teshekpuk Lake
Module Transfer Island
Atigaru Point
Oliktok Point
Oliktok Dock
KUPARUK
CD3
ALPINE
CD1
CD2
CD5
CD4N
Colville River
CPF2
DEADHORSE
BT4
Kalikpik River
Fish (Iqaliqpik) Creek
GMT-1
BT2
INSET A
NUIQSUT
Horizontal Directional Drilling Pads
GMT-2
BT1
Fish (Uvlutuuq) Creek
Judy (Kayyaaq) Creek
Judy (Iqaliqpik) Creek
BT3
Ocean Point
Uhlutuoch (Tinmiaqsiugvik) River
DS2P
BT5
Iikillik River
INSET A
Gravel Mine Site
Uhlutuoch (Tinmiaqsiugvik) River
Bills Creek
0 5 10 Miles
Hydrologic Unit Code (HUC 10)
Colville River
Atigaru Point
Colville River Delta
Garry Creek
Ingaluat Creek-Colville River
Kachemach River
Kalikpik River
Kalubik Creek
Kogru River
McLeod Point
Miluveach River
Outlet Fish Creek
Outlet Itkillik River
Outlet Judy Creek
Pogik Bay
Simpson Lagoon
Smith River
Teshekpuk Lake
Ublutuoch River
Ugnuravik River
Willow Proposed Development Features
Drill Site (Not to Scale)
Bridge
Ice Road
Option 3 Existing Road
Gravel Footprint
Analysis Area
Other Infrastructure
Existing Road
Existing Pipeline
Existing Infrastructure
Land Designation
National Petroleum Reserve in Alaska
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Figure 3.9.1

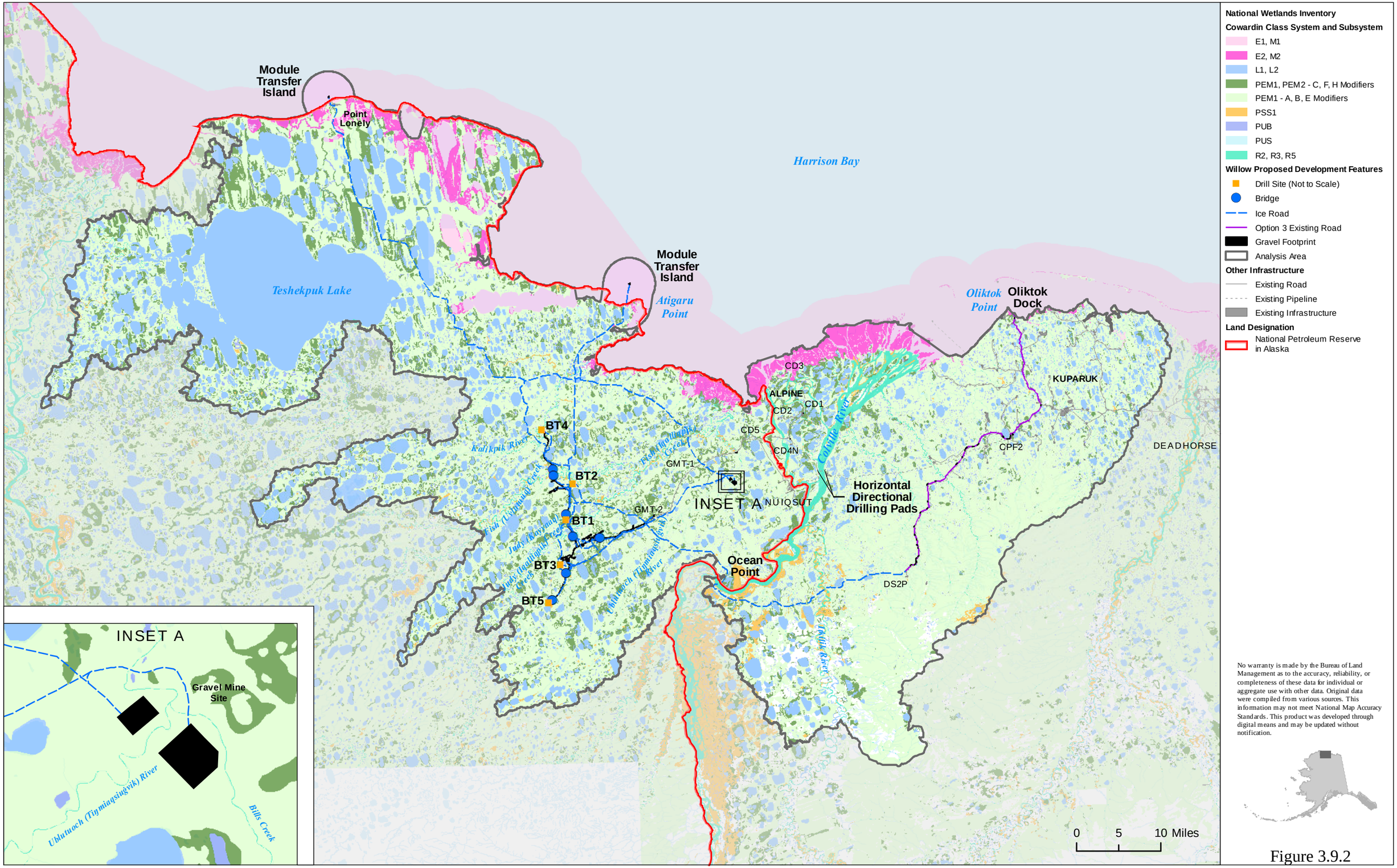
Module Transfer Island
Point Lonely
Harrison Bay
Teshekpuk Lake
Module Transfer Island
Atigaru Point
Oliktok Point
Oliktok Dock
CD3
ALPINE
CD1
CD2
CD5
CD4N
KUPARUK
CPF2
DEADHORSE
BT4
BT2
BT1
BT3
BT5
GMT-1
GMT-2
INSET A
NUIQSUT
Horizontal Directional Drilling Pads
Ocean Point
DS2P
Kalikpik River
Fish (Usimavik) Creek
Judy (Ikroyuak) Creek
Judy (Iowillik) Creek
Ublutuoch (Tinmiaqsiugvik) River
Fish (Ootenilik) Creek
Colville River
Itkillik River
0 5 10 Miles
INSET A
Gravel Mine Site
Ublutuoch (Tinmiaqsiugvik) River
Bills Creek
National Wetlands Inventory
Cowardin Class System and Subsystem
E1, M1
E2, M2
L1, L2
PEM1, PEM2 - C, F, H Modifiers
PEM1 - A, B, E Modifiers
PSS1
PUB
PUS
R2, R3, R5
Willow Proposed Development Features
Drill Site (Not to Scale)
Bridge
Ice Road
Option 3 Existing Road
Gravel Footprint
Analysis Area
Other Infrastructure
Existing Road
Existing Pipeline
Existing Infrastructure
Land Designation
National Petroleum Reserve in Alaska
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Figure 3.9.2

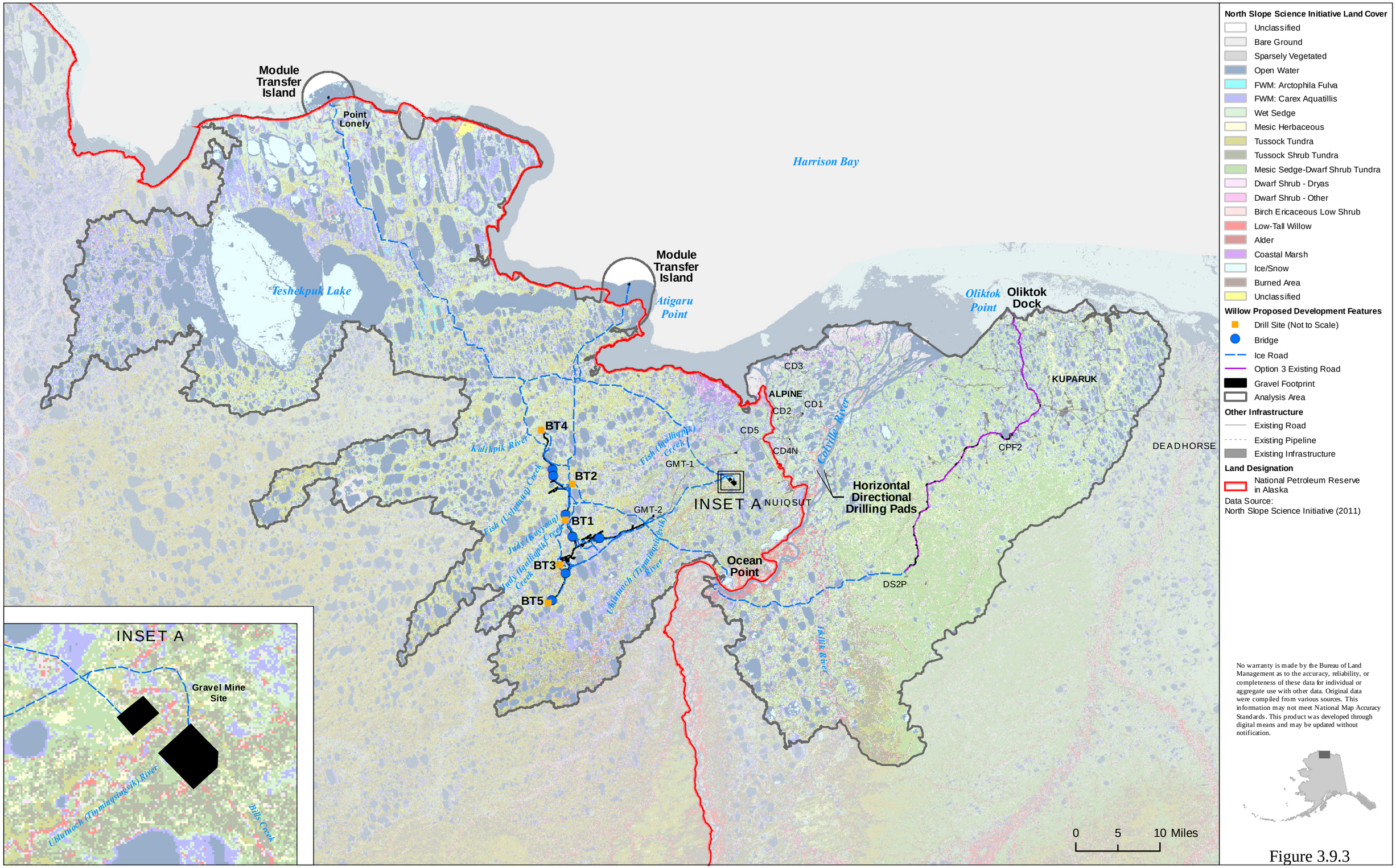

Module Transfer Island
Point Lonely
Harrison Bay
Teshekpuk Lake
Module Transfer Island
Atigaru Point
Oliktok Point
Oliktok Dock
KUPARUK
CD3
ALPINE
CD1
CD2
CD5
CD4N
Colville River
CPF2
DEADHORSE
BT4
Kalikpik River
BT2
Fish (Apelliqpik) Creek
GMT-1
INSET A
NUIQSUT
Horizontal Directional Drilling Pads
GMT-2
BT1
Fish (Uylmaoq) Creek
Judy (Kayyaq) Creek
Judy (Iqalliqpik) Creek
BT3
Ublutuoch (Tiqmiqsingvik) River
Ocean Point
DS2P
BT5
Itkillik River
0 5 10 Miles
INSET A
Gravel Mine Site
Ublutuoch (Tiqmiqsingvik) River
Bills Creek
North Slope Science Initiative Land Cover
Unclassified
Bare Ground
Sparsely Vegetated
Open Water
FWM: Arctophila Fulva
FWM: Carex Aquatillis
Wet Sedge
Mesic Herbaceous
Tussock Tundra
Tussock Shrub Tundra
Mesic Sedge-Dwarf Shrub Tundra
Dwarf Shrub - Dryas
Dwarf Shrub - Other
Birch Ericaceous Low Shrub
Low-Tall Willow
Alder
Coastal Marsh
Ice/Snow
Burned Area
Unclassified
Willow Proposed Development Features
Drill Site (Not to Scale)
Bridge
Ice Road
Option 3 Existing Road
Gravel Footprint
Analysis Area
Other Infrastructure
Existing Road
Existing Pipeline
Existing Infrastructure
Land Designation
National Petroleum Reserve in Alaska
Data Source:
North Slope Science Initiative (2011)
No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources. This information may not meet National Map Accuracy Standards. This product was developed through digital means and may be updated without notification.

Figure 3.9.3

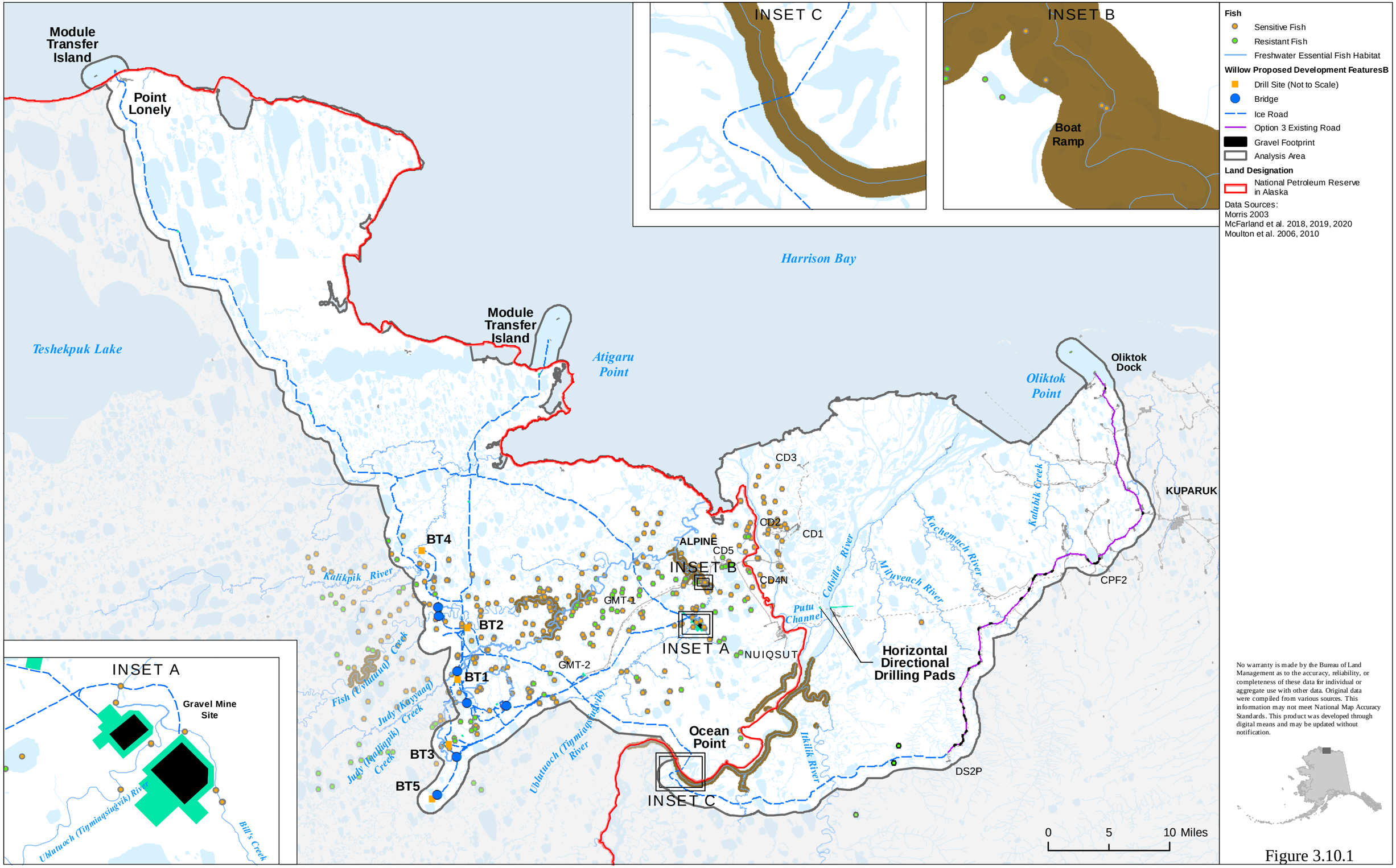

INSET C
INSET B
Boat Ramp
Fish
Sensitive Fish
Resistant Fish
Freshwater Essential Fish Habitat
Willow Proposed Development FeaturesB
Drill Site (Not to Scale)
Bridge
Ice Road
Option 3 Existing Road
Gravel Footprint
Analysis Area
Land Designation
National Petroleum Reserve in Alaska
Data Sources:
Morris 2003
McFarland et al. 2018, 2019, 2020
Moulton et al. 2006, 2010
Module Transfer Island
Point Lonely
Harrison Bay
Teshekpuk Lake
Module Transfer Island
Atigaru Point
Oliktok Point
Oliktok Dock
KUPARUK
CD3
CD2
CD1
ALPINE
CD5
CD4N
INSET B
GMT-1
GMT-2
INSET A
NUIQSUT
Putu Channel
Colville River
Miluveach River
Kachemach River
Kalubik Creek
CPF2
Horizontal Directional Drilling Pads
Ocean Point
INSET C
Ikkilik River
DS2P
BT4
BT2
BT1
BT3
BT5
Kalikpik River
Fish (Uvlutuuq) Creek
Judy (Kayyaaq) Creek
Judy (Kadliqpik) Creek
Ublutuoch (Tiŋmiaqsiugvik) River
0
5
10 Miles
INSET A
Gravel Mine Site
Ublutuoch (Tiŋmiaqsiugvik) River
Bill's Creek
No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources. This information may not meet National Map Accuracy Standards. This product was developed through digital means and may be updated without notification.

Figure 3.10.1

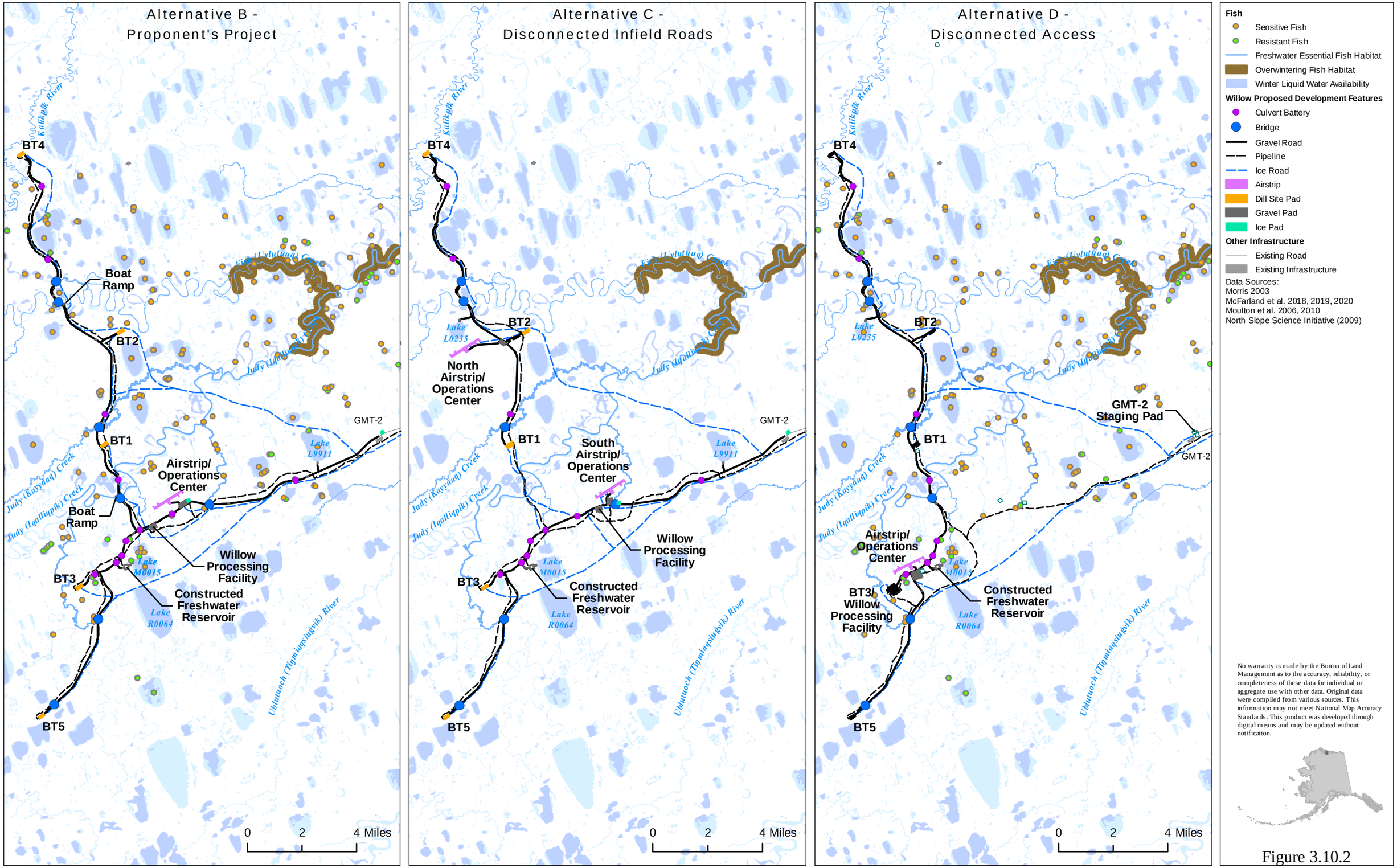

Alternative B - Proponent's Project
Alternative C - Disconnected Infield Roads
Alternative D - Disconnected Access
Kalikpik River
BT1
BT2
BT3
BT4
BT5
Boat Ramp
Airstrip/ Operations Center
North Airstrip/ Operations Center
South Airstrip/ Operations Center
Willow Processing Facility
Constructed Freshwater Reservoir
GMT-2
GMT-2 Staging Pad
Lake L0235
Lake L9911
Lake M0015
Lake R0064
Judy (Kayḋaaq) Creek
Judy (Iqaliiqpik) Creek
Ubluuwoch (Tipnaiqsiugvik) River
0 2 4 Miles
Fish
Sensitive Fish
Resistant Fish
Freshwater Essential Fish Habitat
Overwintering Fish Habitat
Winter Liquid Water Availability
Willow Proposed Development Features
Culvert Battery
Bridge
Gravel Road
Pipeline
Ice Road
Airstrip
Dill Site Pad
Gravel Pad
Ice Pad
Other Infrastructure
Existing Road
Existing Infrastructure
Data Sources:
Morris 2003
McFarland et al. 2018, 2019, 2020
Moulton et al. 2006, 2010
North Slope Science Initiative (2009)
No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources. This information may not meet National Map Accuracy Standards. This product was developed through digital means and may be updated without notification.

Figure 3.10.2

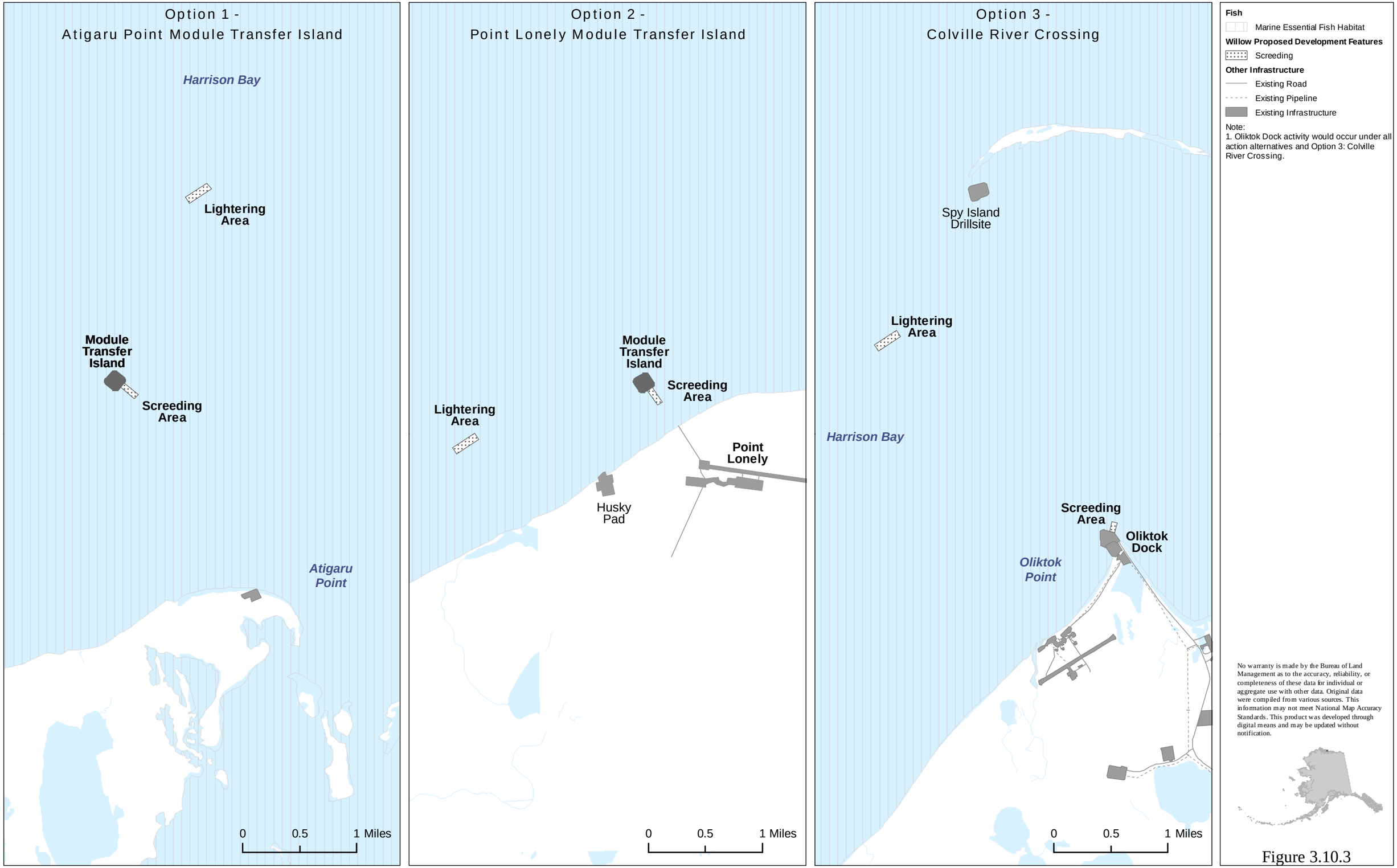
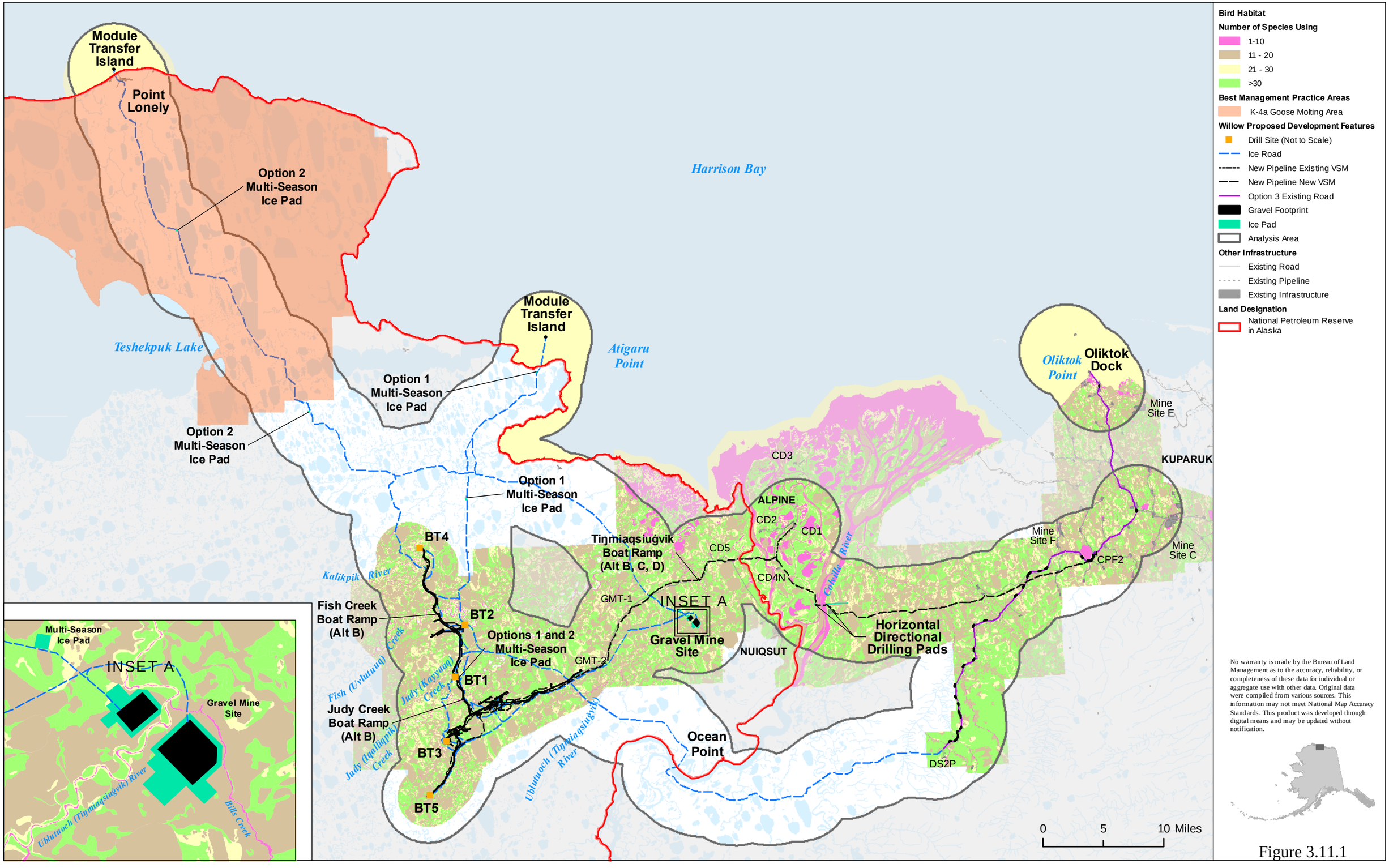

Option 1 -
Atigaru Point Module Transfer Island
Harrison Bay
Lightering Area
Module Transfer Island
Screeding Area
Atigaru Point
0 0.5 1 Miles
Option 2 -
Point Lonely Module Transfer Island
Module Transfer Island
Screeding Area
Lightering Area
Point Lonely
Husky Pad
0 0.5 1 Miles
Option 3 -
Colville River Crossing
Spy Island Drillsite
Lightering Area
Harrison Bay
Screeding Area
Oliktok Dock
Oliktok Point
0 0.5 1 Miles
Fish
Marine Essential Fish Habitat
Willow Proposed Development Features
Screeding
Other Infrastructure
Existing Road
Existing Pipeline
Existing Infrastructure
Note:
1. Oliktok Dock activity would occur under all action alternatives and Option 3: Colville River Crossing.
No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources. This information may not meet National Map Accuracy Standards. This product was developed through digital means and may be updated without notification.

Figure 3.10.3



No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources. This information may not meet National Map Accuracy Standards. This product was developed through digital means and may be updated without notification.

Figure 3.11.1

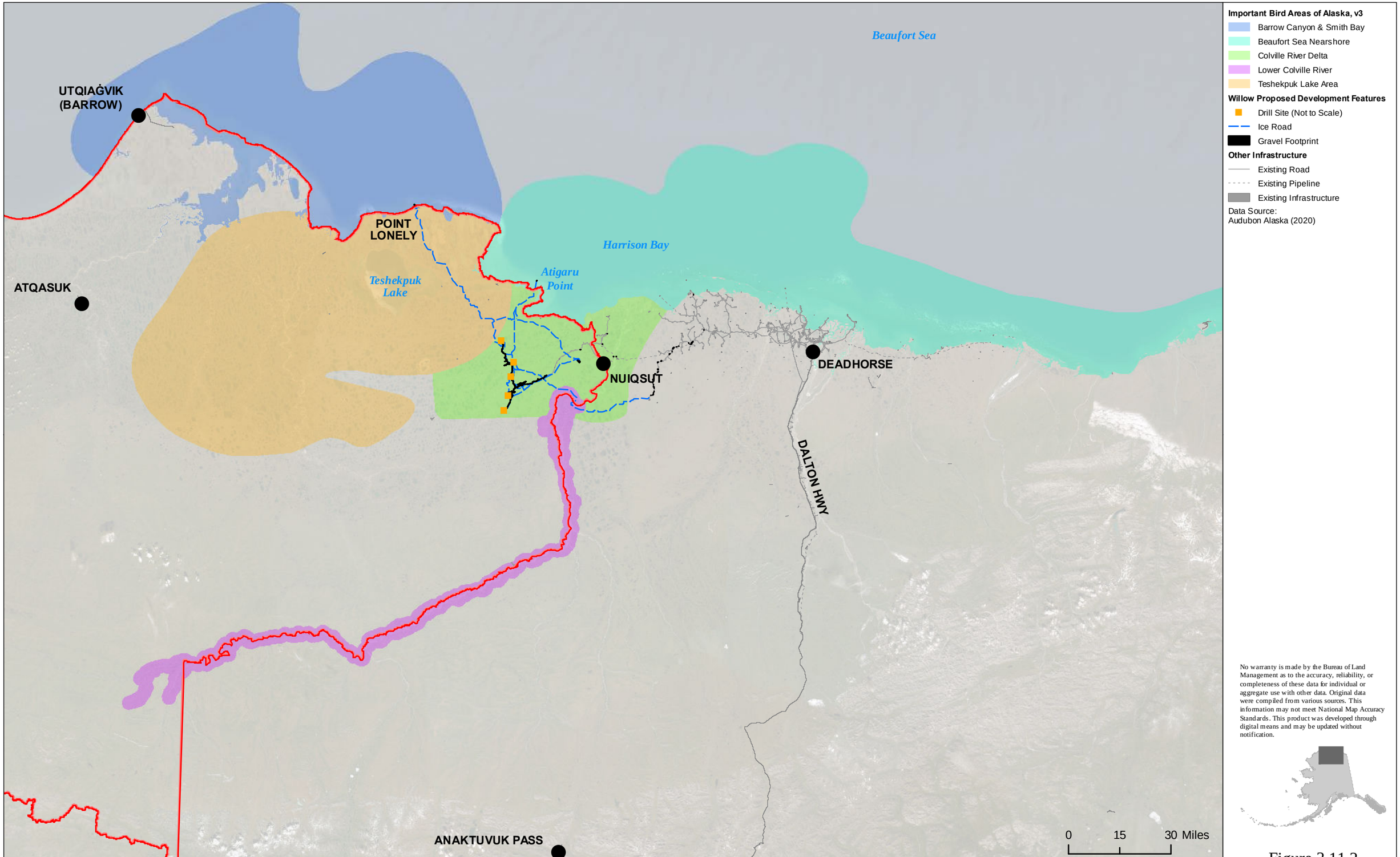

Beaufort Sea
UTQIAĠVIK
(BARROW)
ATQASUK
POINT
LONELY
Teshekpuk
Lake
Harrison Bay
Atigaru
Point
NUIQSUT
DEADHORSE
DALTON HWY
ANAKTUVUK PASS
0
15
30 Miles
Important Bird Areas of Alaska, v3
Barrow Canyon & Smith Bay
Beaufort Sea Nearshore
Colville River Delta
Lower Colville River
Teshekpuk Lake Area
Willow Proposed Development Features
Drill Site (Not to Scale)
Ice Road
Gravel Footprint
Other Infrastructure
Existing Road
Existing Pipeline
Existing Infrastructure
Data Source:
Audubon Alaska (2020)
No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources. This information may not meet National Map Accuracy Standards. This product was developed through digital means and may be updated without notification.

Figure 3.11.2

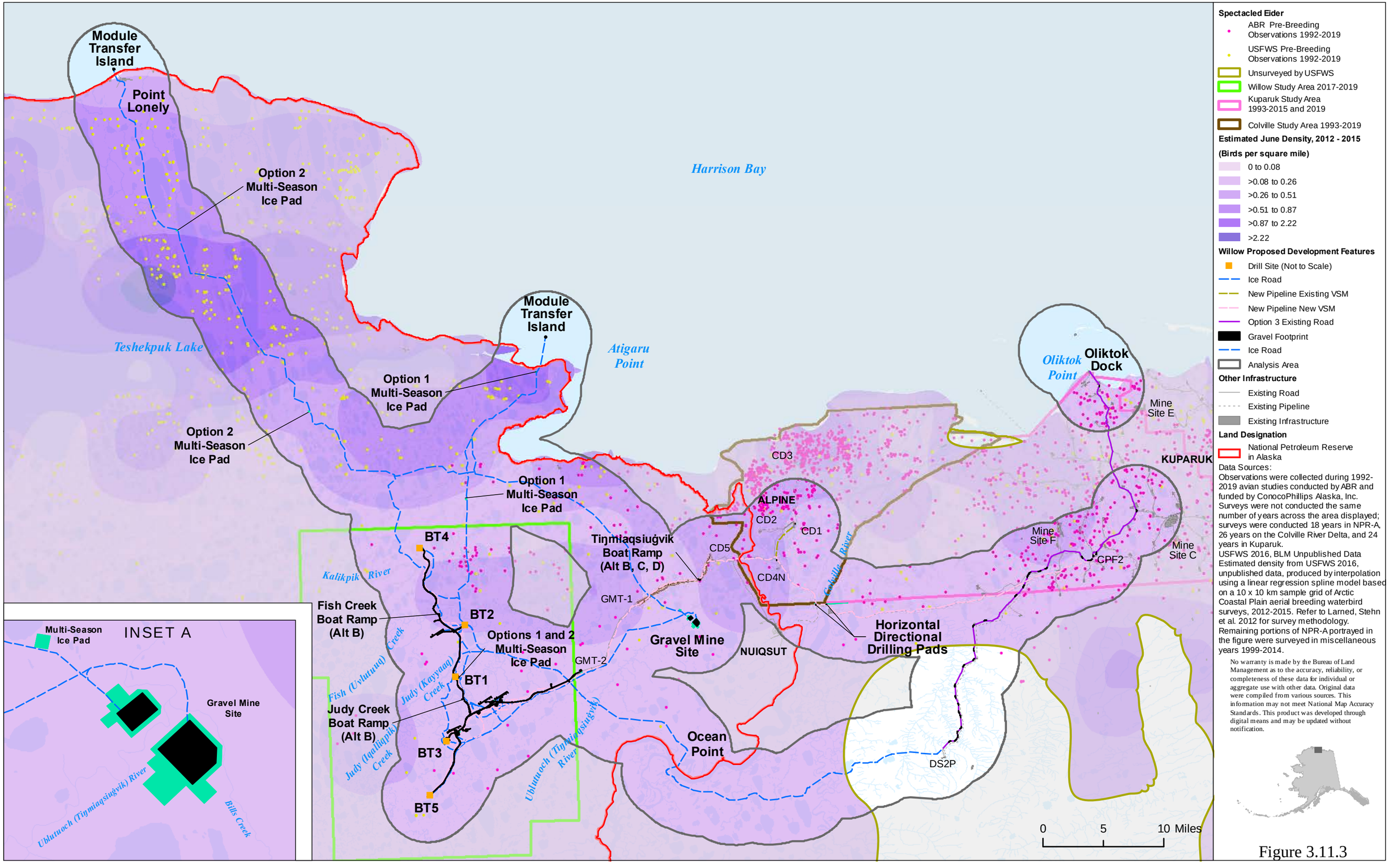

Module Transfer Island
Point Lonely
Option 2 Multi-Season Ice Pad
Harrison Bay
Teshekpuk Lake
Module Transfer Island
Atigaru Point
Option 1 Multi-Season Ice Pad
Option 2 Multi-Season Ice Pad
Oliktok Point
Oliktok Dock
Mine Site E
CD3
KUPARUK
Option 1 Multi-Season Ice Pad
ALPINE
CD2
CD1
BT4
Tiŋmiaqsiuġvik Boat Ramp (Alt B, C, D)
CD5
Colville River
Mine Site F
CPF2
Mine Site C
Kalikpik River
CD4N
GMT-1
Fish Creek Boat Ramp (Alt B)
BT2
Options 1 and 2 Multi-Season Ice Pad
Gravel Mine Site
NUIQSUT
Horizontal Directional Drilling Pads
GMT-2
BT1
Fish (Uvlutuuq) Creek
Judy (Kayyaaq) Creek
Judy Creek Boat Ramp (Alt B)
Judy (Iqaliqpik) Creek
BT3
Ocean Point
Ublutuoch (Tiŋmiaqsiuġvik) River
DS2P
BT5
0 5 10 Miles
INSET A
Multi-Season Ice Pad
Gravel Mine Site
Ublutuoch (Tiŋmiaqsiuġvik) River
Bills Creek
Spectacled Eider
ABR Pre-Breeding Observations 1992-2019
USFWS Pre-Breeding Observations 1992-2019
Unsurveyed by USFWS
Willow Study Area 2017-2019
Kuparuk Study Area 1993-2015 and 2019
Colville Study Area 1993-2019
Estimated June Density, 2012 - 2015
(Birds per square mile)
0 to 0.08
>0.08 to 0.26
>0.26 to 0.51
>0.51 to 0.87
>0.87 to 2.22
>2.22
Willow Proposed Development Features
Drill Site (Not to Scale)
Ice Road
New Pipeline Existing VSM
New Pipeline New VSM
Option 3 Existing Road
Gravel Footprint
Ice Road
Analysis Area
Other Infrastructure
Existing Road
Existing Pipeline
Existing Infrastructure
Land Designation
National Petroleum Reserve in Alaska
Data Sources:
Observations were collected during 1992-2019 avian studies conducted by ABR and funded by ConocoPhillips Alaska, Inc. Surveys were not conducted the same number of years across the area displayed; surveys were conducted 18 years in NPR-A, 26 years on the Colville River Delta, and 24 years in Kuparuk.
USFWS 2016, BLM Unpublished Data
Estimated density from USFWS 2016, unpublished data, produced by interpolation using a linear regression spline model based on a 10 x 10 km sample grid of Arctic Coastal Plain aerial breeding waterbird surveys, 2012-2015. Refer to Larned, Stehn et al. 2012 for survey methodology. Remaining portions of NPR-A portrayed in the figure were surveyed in miscellaneous years 1999-2014.
No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources. This information may not meet National Map Accuracy Standards. This product was developed through digital means and may be updated without notification.

Figure 3.11.3

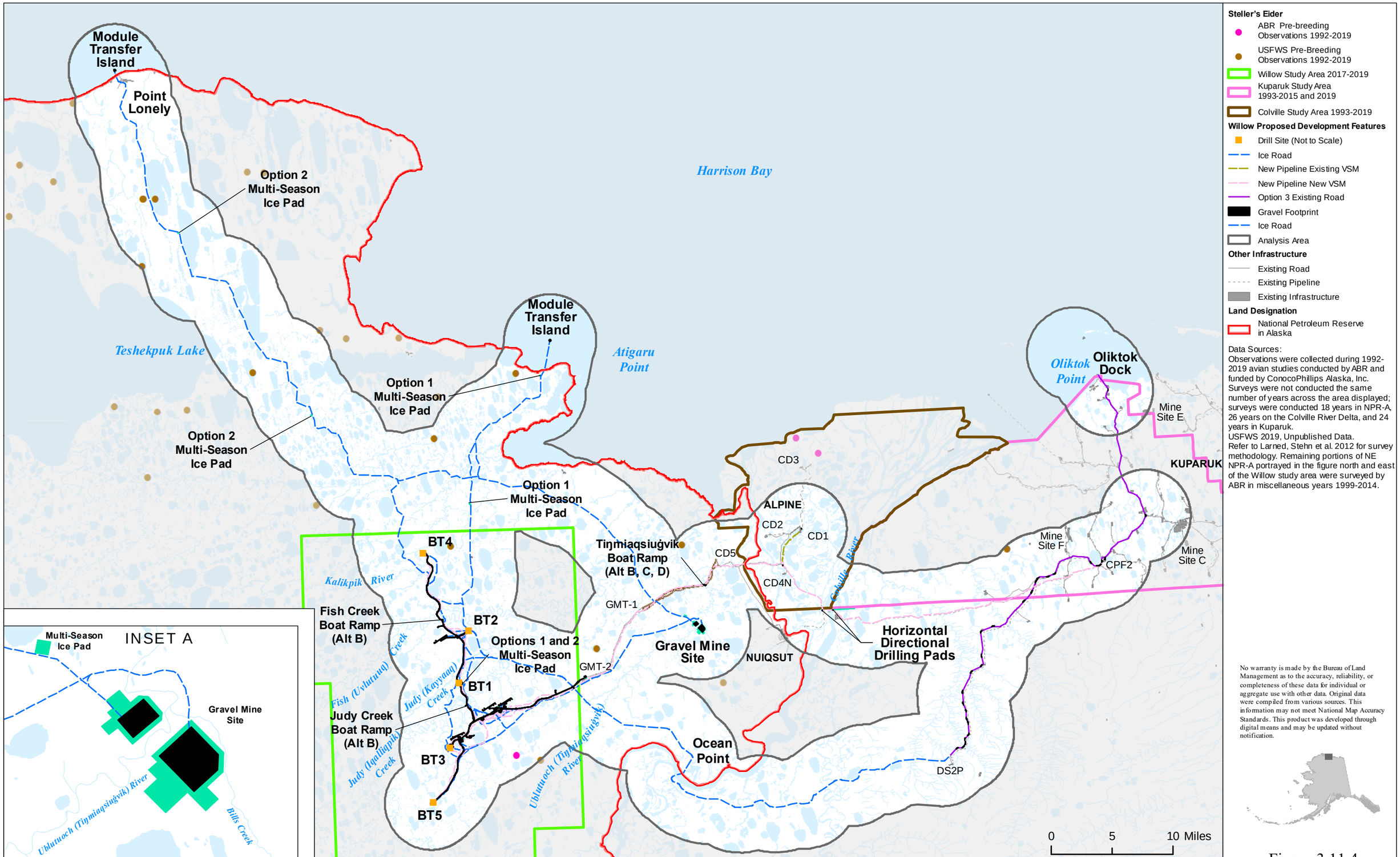

Module Transfer Island
Point Lonely
Option 2 Multi-Season Ice Pad
Harrison Bay
Teshekpuk Lake
Module Transfer Island
Atigaru Point
Option 1 Multi-Season Ice Pad
Option 2 Multi-Season Ice Pad
Option 1 Multi-Season Ice Pad
Oliktok Point
Oliktok Dock
Mine Site E
KUPARUK
CD3
ALPINE
CD2
CD1
CD5
CD4N
Colville River
Mine Site F
CPF2
Mine Site C
BT4
Kalikpik River
Tiŋmiaqsiuġvik Boat Ramp (Alt B, C, D)
GMT-1
Fish Creek Boat Ramp (Alt B)
BT2
Options 1 and 2 Multi-Season Ice Pad
Gravel Mine Site
NUIQSUT
Horizontal Directional Drilling Pads
GMT-2
BT1
Fish (Uvlutuuq) Creek
Judy (Kayyauq) Creek
Judy Creek Boat Ramp (Alt B)
Judy (Iqaliqpik) Creek
BT3
Ublutuoch (Tiŋmiaqsiuġvik) River
Ocean Point
DS2P
BT5
0 5 10 Miles
INSET A
Multi-Season Ice Pad
Gravel Mine Site
Ublutuoch (Tiŋmiaqsiuġvik) River
Bills Creek
Steller's Eider
ABR Pre-breeding Observations 1992-2019
USFWS Pre-Breeding Observations 1992-2019
Willow Study Area 2017-2019
Kuparuk Study Area 1993-2015 and 2019
Colville Study Area 1993-2019
Willow Proposed Development Features
Drill Site (Not to Scale)
Ice Road
New Pipeline Existing VSM
New Pipeline New VSM
Option 3 Existing Road
Gravel Footprint
Ice Road
Analysis Area
Other Infrastructure
Existing Road
Existing Pipeline
Existing Infrastructure
Land Designation
National Petroleum Reserve in Alaska
Data Sources:
Observations were collected during 1992-2019 avian studies conducted by ABR and funded by ConocoPhillips Alaska, Inc. Surveys were not conducted the same number of years across the area displayed; surveys were conducted 18 years in NPR-A, 26 years on the Colville River Delta, and 24 years in Kuparuk.
USFWS 2019, Unpublished Data.
Refer to Larned, Stehn et al. 2012 for survey methodology. Remaining portions of NE NPR-A portrayed in the figure north and east of the Willow study area were surveyed by ABR in miscellaneous years 1999-2014.
No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources. This information may not meet National Map Accuracy Standards. This product was developed through digital means and may be updated without notification.

Figure 3.11.4

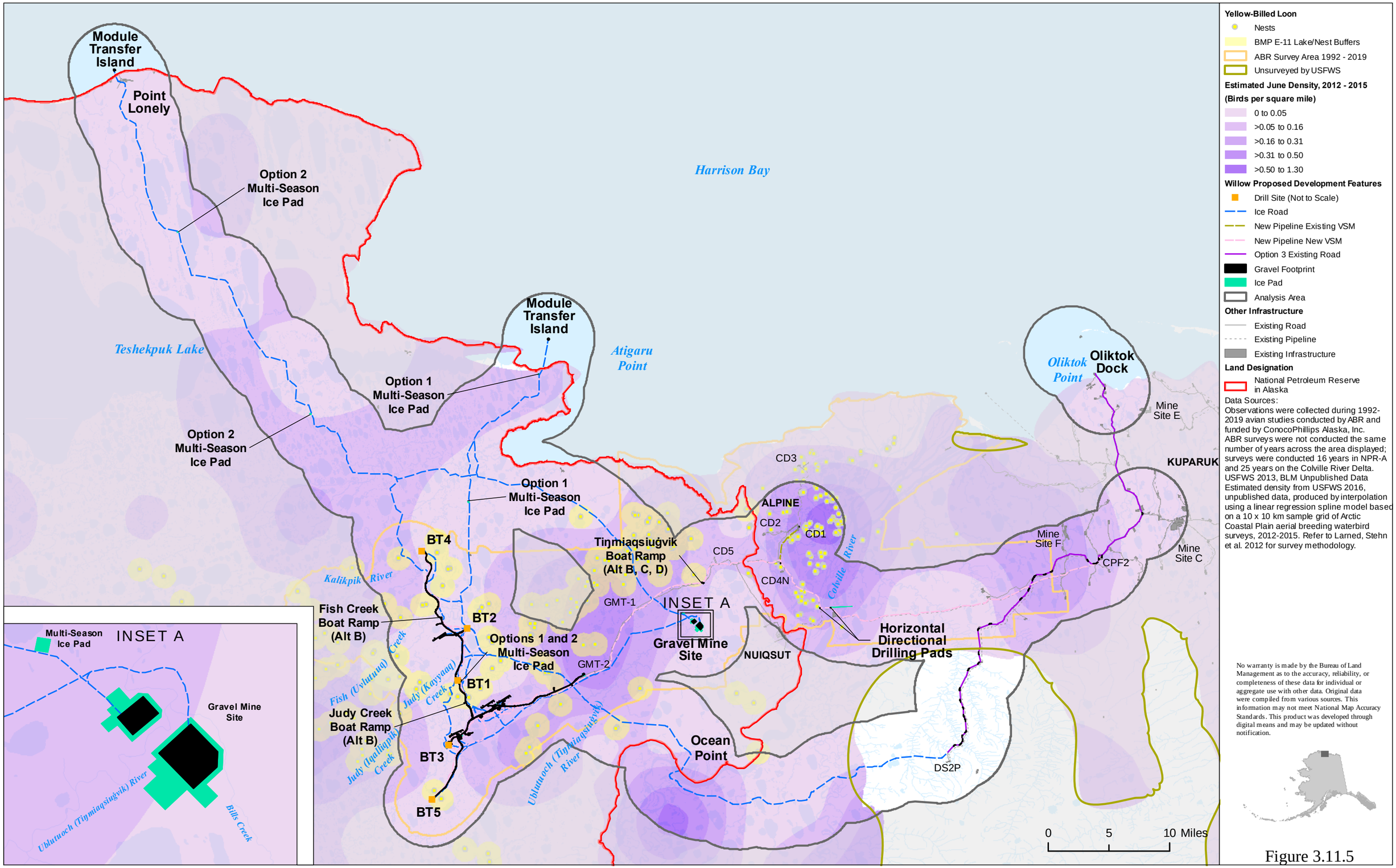

Module Transfer Island
Point Lonely
Option 2 Multi-Season Ice Pad
Harrison Bay
Teshekpuk Lake
Module Transfer Island
Atigaru Point
Option 1 Multi-Season Ice Pad
Option 2 Multi-Season Ice Pad
Oliktok Point
Oliktok Dock
Mine Site E
CD3
KUPARUK
Option 1 Multi-Season Ice Pad
ALPINE
CD2
CD1
Colville River
Mine Site F
CPF2
Mine Site C
BT4
Tiŋmiaqsiuġvik Boat Ramp (Alt B, C, D)
CD5
CD4N
Kalikpik River
GMT-1
INSET A
Fish Creek Boat Ramp (Alt B)
BT2
Options 1 and 2 Multi-Season Ice Pad
Gravel Mine Site
NUIQSUT
Horizontal Directional Drilling Pads
GMT-2
Fish (Uvlutuuq) Creek
Judy (Kayyaaq) Creek
BT1
Judy Creek Boat Ramp (Alt B)
Judy (Iqaliqpik) Creek
BT3
Ublutuoch (Tiŋmiaqsiuġvik) River
Ocean Point
DS2P
BT5
0 5 10 Miles
Multi-Season Ice Pad
INSET A
Gravel Mine Site
Ublutuoch (Tiŋmiaqsiuġvik) River
Bills Creek
Yellow-Billed Loon
Nests
BMP E-11 Lake/Nest Buffers
ABR Survey Area 1992 - 2019
Unsurveyed by USFWS
Estimated June Density, 2012 - 2015
(Birds per square mile)
0 to 0.05
>0.05 to 0.16
>0.16 to 0.31
>0.31 to 0.50
>0.50 to 1.30
Willow Proposed Development Features
Drill Site (Not to Scale)
Ice Road
New Pipeline Existing VSM
New Pipeline New VSM
Option 3 Existing Road
Gravel Footprint
Ice Pad
Analysis Area
Other Infrastructure
Existing Road
Existing Pipeline
Existing Infrastructure
Land Designation
National Petroleum Reserve in Alaska
Data Sources:
Observations were collected during 1992-2019 avian studies conducted by ABR and funded by ConocoPhillips Alaska, Inc. ABR surveys were not conducted the same number of years across the area displayed; surveys were conducted 16 years in NPR-A and 25 years on the Colville River Delta. USFWS 2013, BLM Unpublished Data Estimated density from USFWS 2016, unpublished data, produced by interpolation using a linear regression spline model based on a 10 x 10 km sample grid of Arctic Coastal Plain aerial breeding waterbird surveys, 2012-2015. Refer to Larned, Stehn et al. 2012 for survey methodology.
No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources. This information may not meet National Map Accuracy Standards. This product was developed through digital means and may be updated without notification.

Figure 3.11.5

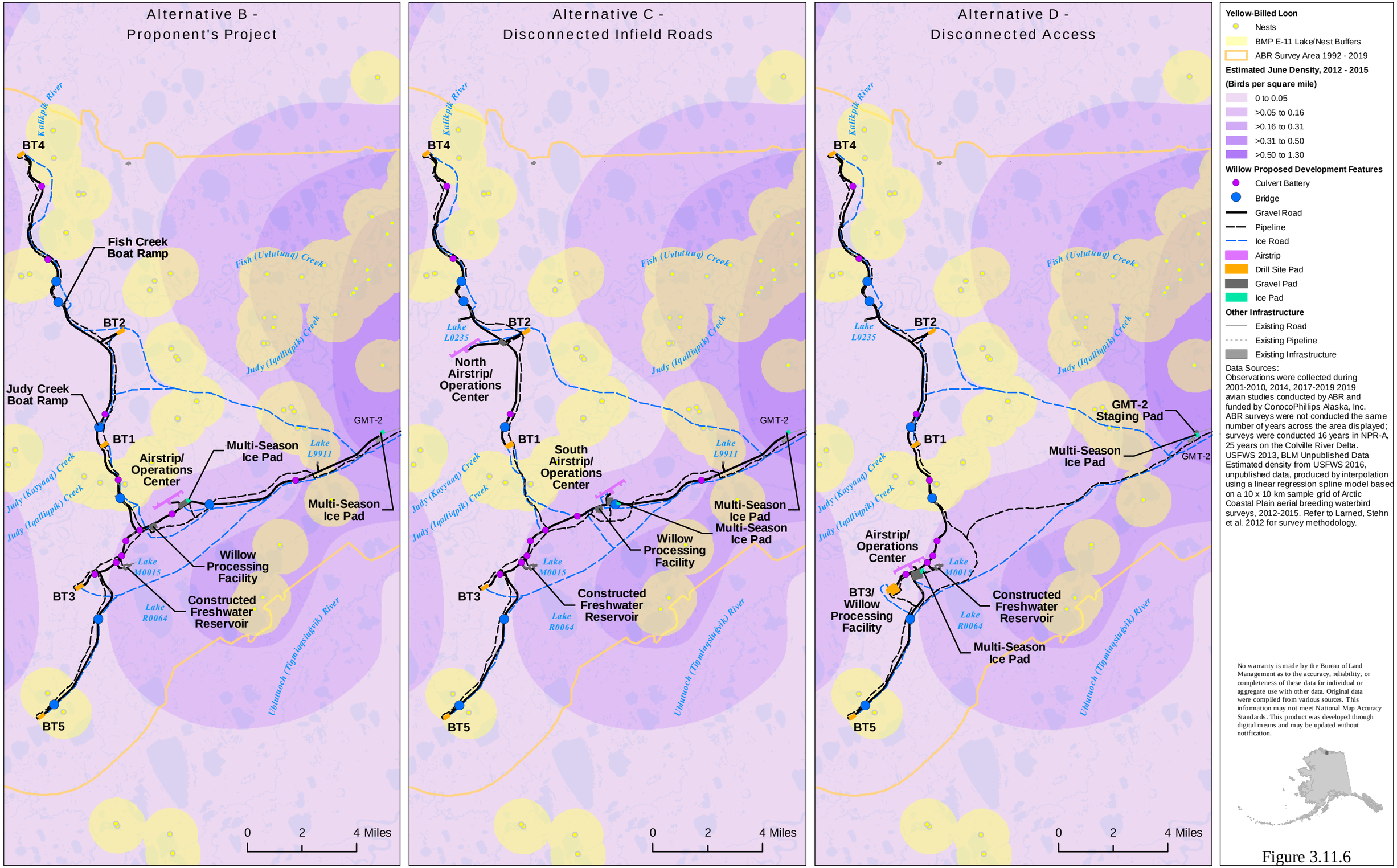

Alternative B - Proponent's Project
Alternative C - Disconnected Infield Roads
Alternative D - Disconnected Access
Kalikpik River
Fish (Uylutuuq) Creek
Judy (Iqaliiqpik) Creek
Judy (Kayyaaq) Creek
Ubluuwoch (Tipmiaqsiugvik) River
BT1
BT2
BT3
BT4
BT5
Fish Creek Boat Ramp
Judy Creek Boat Ramp
Airstrip/ Operations Center
Multi-Season Ice Pad
Willow Processing Facility
Constructed Freshwater Reservoir
Lake M0015
Lake R0064
Lake L0235
Lake L9911
GMT-2
North Airstrip/ Operations Center
South Airstrip/ Operations Center
BT3/ Willow Processing Facility
GMT-2 Staging Pad
0 2 4 Miles
Yellow-Billed Loon
Nests
BMP E-11 Lake/Nest Buffers
ABR Survey Area 1992 - 2019
Estimated June Density, 2012 - 2015
(Birds per square mile)
0 to 0.05
>0.05 to 0.16
>0.16 to 0.31
>0.31 to 0.50
>0.50 to 1.30
Willow Proposed Development Features
Culvert Battery
Bridge
Gravel Road
Pipeline
Ice Road
Airstrip
Drill Site Pad
Gravel Pad
Ice Pad
Other Infrastructure
Existing Road
Existing Pipeline
Existing Infrastructure
Data Sources:
Observations were collected during 2001-2010, 2014, 2017-2019 2019 avian studies conducted by ABR and funded by ConocoPhillips Alaska, Inc. ABR surveys were not conducted the same number of years across the area displayed; surveys were conducted 16 years in NPR-A, 25 years on the Colville River Delta. USFWS 2013, BLM Unpublished Data Estimated density from USFWS 2016, unpublished data, produced by interpolation using a linear regression spline model based on a 10 x 10 km sample grid of Arctic Coastal Plain aerial breeding waterbird surveys, 2012-2015. Refer to Larned, Stehn et al. 2012 for survey methodology.
No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources. This information may not meet National Map Accuracy Standards. This product was developed through digital means and may be updated without notification.

Figure 3.11.6

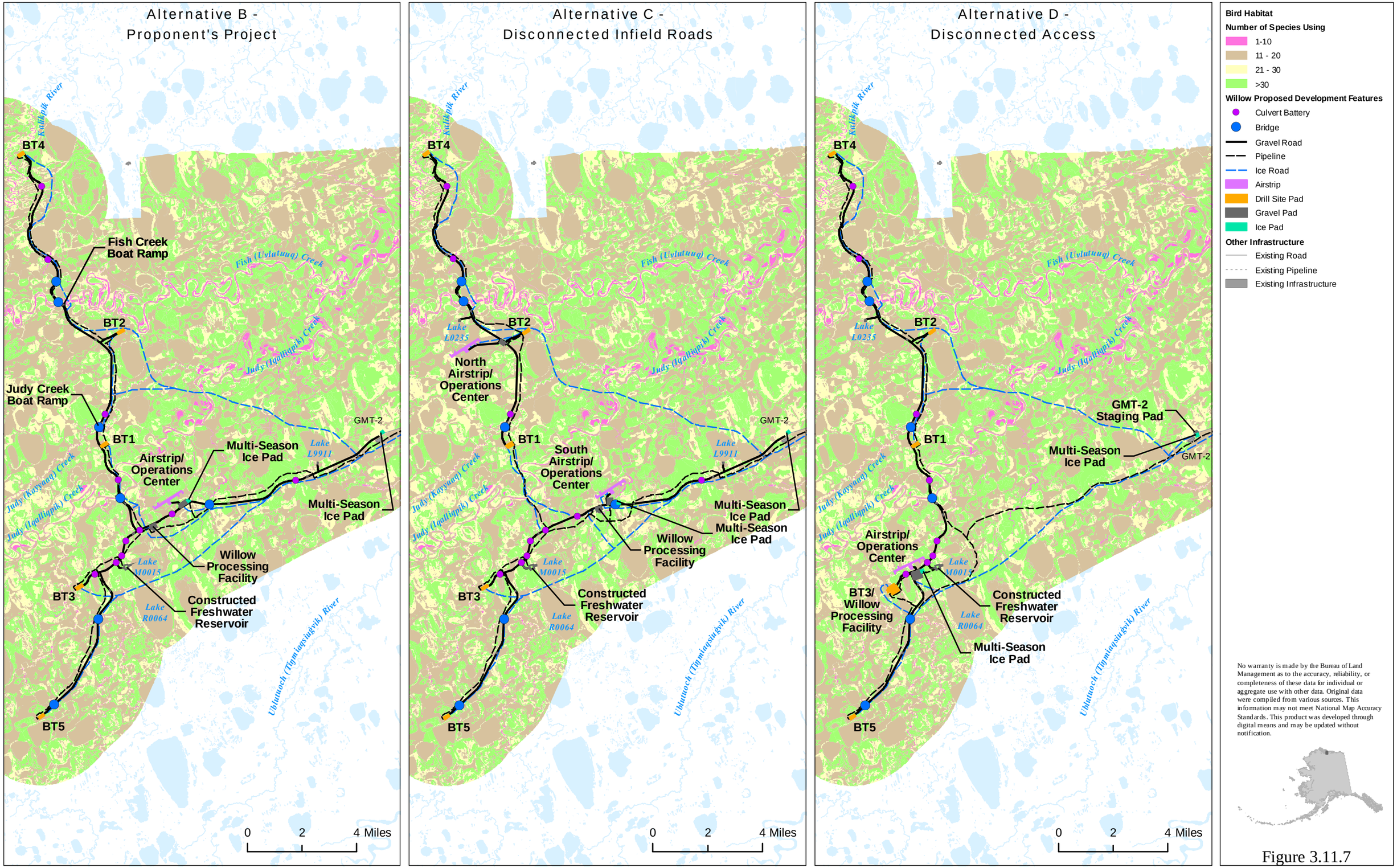

Alternative B -
Proponent's Project
Alternative C -
Disconnected Infield Roads
Alternative D -
Disconnected Access
Kalikpik River
Fish (Uylutuuq) Creek
Judy (Iqalliqpik) Creek
Judy (Kayyaaq) Creek
Ublutuoch (Tipnitapsiugvik) River
Lake L0235
Lake L9911
Lake M0015
Lake R0064
BT1
BT2
BT3
BT4
BT5
BT3/ Willow Processing Facility
Fish Creek Boat Ramp
Judy Creek Boat Ramp
Airstrip/ Operations Center
North Airstrip/ Operations Center
South Airstrip/ Operations Center
Multi-Season Ice Pad
Willow Processing Facility
Constructed Freshwater Reservoir
GMT-2
GMT-2 Staging Pad
0 2 4 Miles
Bird Habitat
Number of Species Using
1-10
11 - 20
21 - 30
>30
Willow Proposed Development Features
Culvert Battery
Bridge
Gravel Road
Pipeline
Ice Road
Airstrip
Drill Site Pad
Gravel Pad
Ice Pad
Other Infrastructure
Existing Road
Existing Pipeline
Existing Infrastructure
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Figure 3.11.7

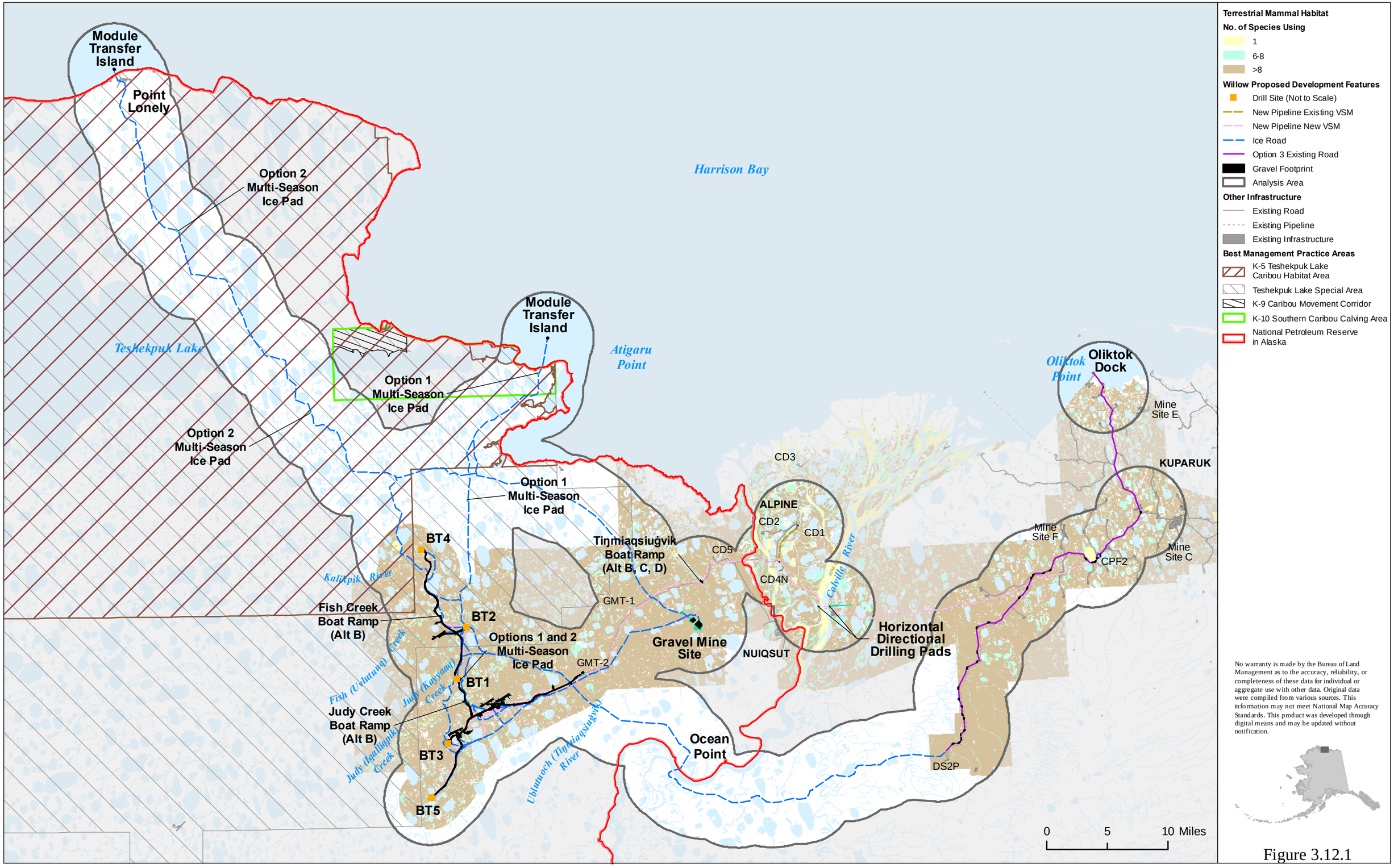

Module Transfer Island
Point Lonely
Option 2 Multi-Season Ice Pad
Harrison Bay
Teshekpuk Lake
Module Transfer Island
Atigaru Point
Option 1 Multi-Season Ice Pad
Option 2 Multi-Season Ice Pad
Option 1 Multi-Season Ice Pad
Oliktok Point
Oliktok Dock
Mine Site E
CD3
KUPARUK
ALPINE
CD2
CD1
Mine Site F
Mine Site C
CPF2
BT4
Tiŋmiaqsiuġvik Boat Ramp (Alt B, C, D)
CD5
CD4N
Colville River
Kalikpik River
GMT-1
Fish Creek Boat Ramp (Alt B)
BT2
Options 1 and 2 Multi-Season Ice Pad
Gravel Mine Site
NUIQSUT
Horizontal Directional Drilling Pads
GMT-2
BT1
Fish (Ulluruna) Creek
Judy (Kayyaan) Creek
Judy Creek Boat Ramp (Alt B)
Judy (Iqalliqpik) Creek
BT3
Ocean Point
Ublutuoch (Tiŋmiaqsiuġvik) River
DS2P
BT5
0 5 10 Miles
Terrestrial Mammal Habitat
No. of Species Using
1
6-8
>8
Willow Proposed Development Features
Drill Site (Not to Scale)
New Pipeline Existing VSM
New Pipeline New VSM
Ice Road
Option 3 Existing Road
Gravel Footprint
Analysis Area
Other Infrastructure
Existing Road
Existing Pipeline
Existing Infrastructure
Best Management Practice Areas
K-5 Teshekpuk Lake Caribou Habitat Area
Teshekpuk Lake Special Area
K-9 Caribou Movement Corridor
K-10 Southern Caribou Calving Area
National Petroleum Reserve in Alaska
No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources. This information may not meet National Map Accuracy Standards. This product was developed through digital means and may be updated without notification.

Figure 3.12.1

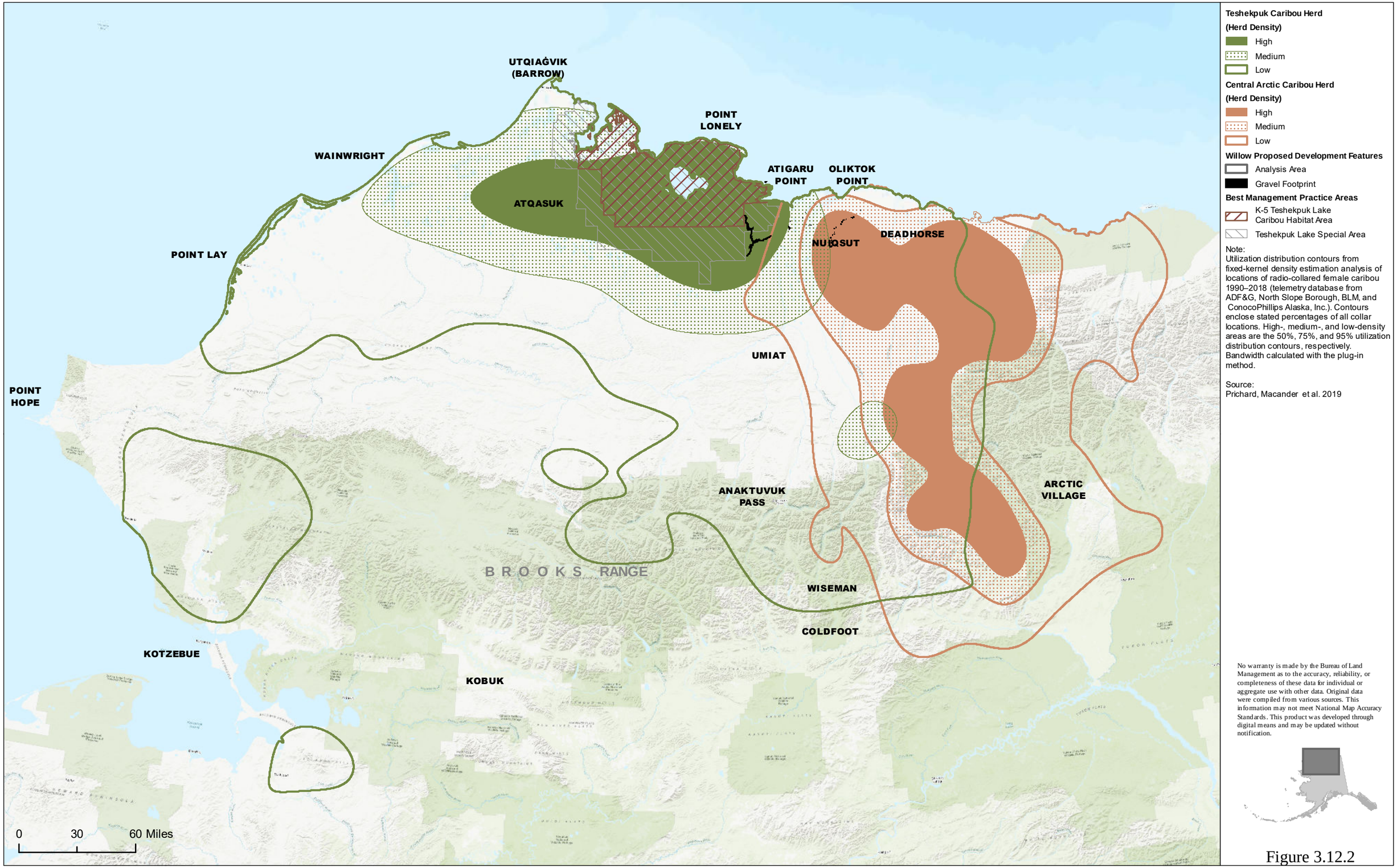
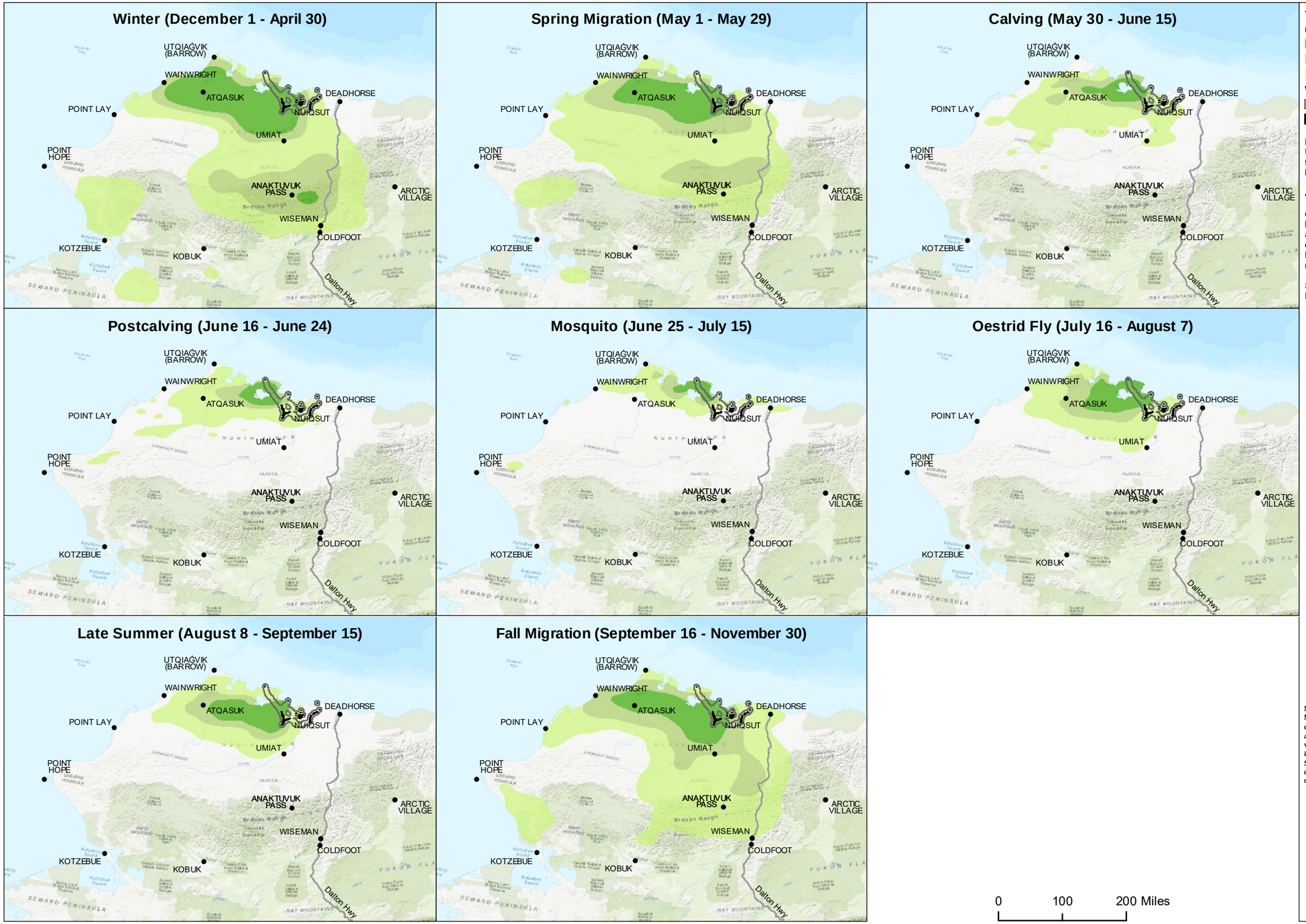

UTQIAĠVIK (BARROW)
POINT LONELY
WAINWRIGHT
ATIGARU POINT
OLIKTOK POINT
ATQASUK
DEADHORSE
NUIQSUT
POINT LAY
UMIAT
POINT HOPE
ANAKTUVUK PASS
ARCTIC VILLAGE
BROOKS RANGE
WISEMAN
COLDFOOT
KOTZEBUE
KOBUK
0 30 60 Miles
Teshekpuk Caribou Herd
(Herd Density)
High
Medium
Low
Central Arctic Caribou Herd
(Herd Density)
High
Medium
Low
Willow Proposed Development Features
Analysis Area
Gravel Footprint
Best Management Practice Areas
K-5 Teshekpuk Lake Caribou Habitat Area
Teshekpuk Lake Special Area
Note:
Utilization distribution contours from fixed-kernel density estimation analysis of locations of radio-collared female caribou 1990–2018 (telemetry database from ADF&G, North Slope Borough, BLM, and ConocoPhillips Alaska, Inc.). Contours enclose stated percentages of all collar locations. High-, medium-, and low-density areas are the 50%, 75%, and 95% utilization distribution contours, respectively. Bandwidth calculated with the plug-in method.
Source:
Prichard, Macander et al. 2019
No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources. This information may not meet National Map Accuracy Standards. This product was developed through digital means and may be updated without notification.

Figure 3.12.2



Teshekpuk Caribou Herd
(Female Density)
- High
- Medium
- Low

Willow Proposed Development Features
- Analysis Area
- Gravel Footprint

Note:
Utilization distribution contours from fixed-kernel density estimation analysis of locations of radio-collared female caribou 1990–2018 (telemetry database from ADF&G, North Slope Borough, BLM, and ConocoPhillips Alaska, Inc.). Contours enclose stated percentages of all collar locations. High-, medium-, and low-density areas are the 50%, 75%, and 95% utilization distribution contours, respectively. Bandwidth calculated with the plug-in method.

Source:
Prichard, Macander et al. 2019

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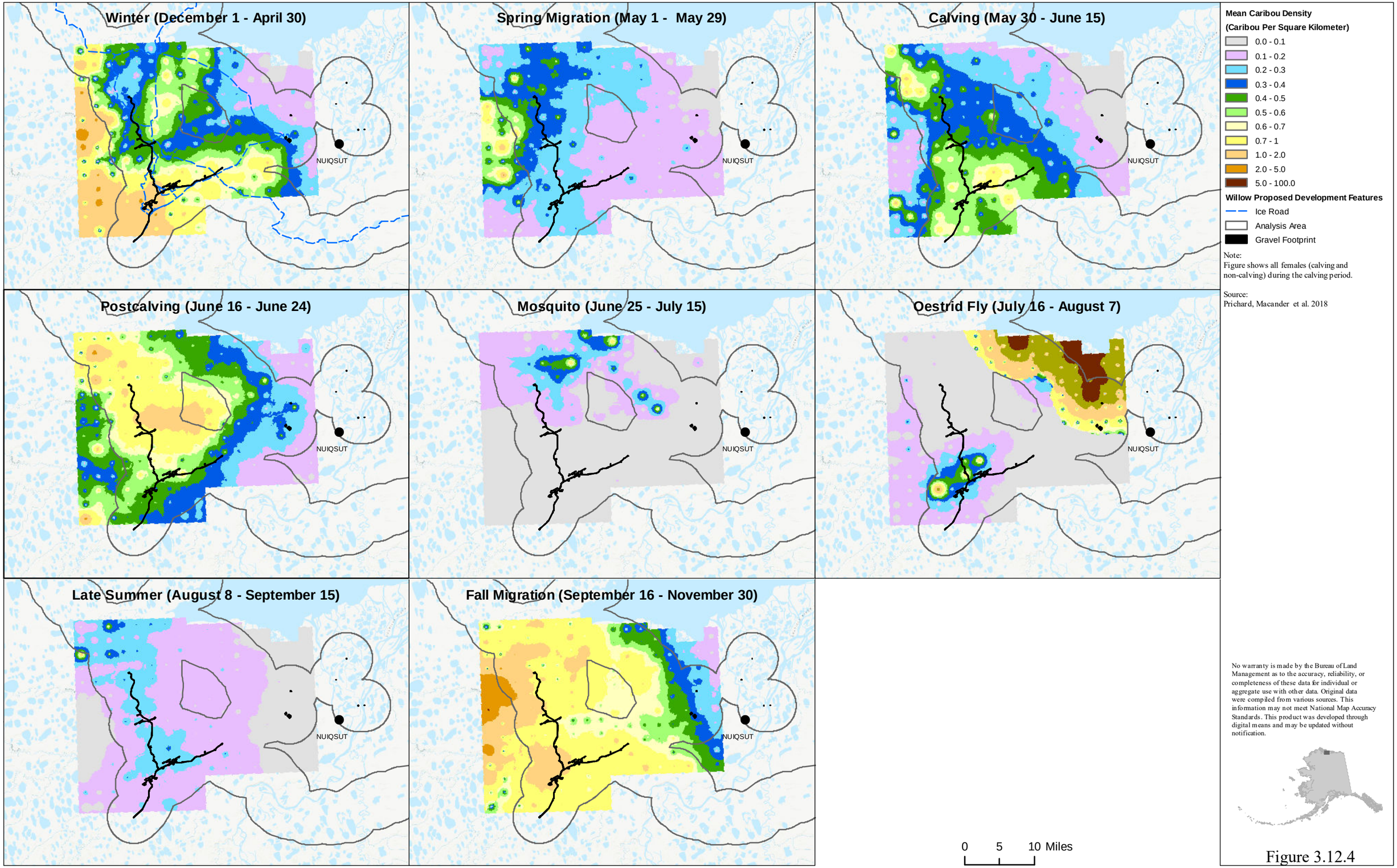
Figure 3.12.3


Winter (December 1 - April 30)
Spring Migration (May 1 - May 29)
Calving (May 30 - June 15)
Postcalving (June 16 - June 24)
Mosquito (June 25 - July 15)
Oestrid Fly (July 16 - August 7)
Late Summer (August 8 - September 15)
Fall Migration (September 16 - November 30)
NUIQSUT
Mean Caribou Density
(Caribou Per Square Kilometer)
0.0 - 0.1
0.1 - 0.2
0.2 - 0.3
0.3 - 0.4
0.4 - 0.5
0.5 - 0.6
0.6 - 0.7
0.7 - 1
1.0 - 2.0
2.0 - 5.0
5.0 - 100.0
Willow Proposed Development Features
Ice Road
Analysis Area
Gravel Footprint
Note:
Figure shows all females (calving and non-calving) during the calving period.
Source:
Prichard, Macander et al. 2018
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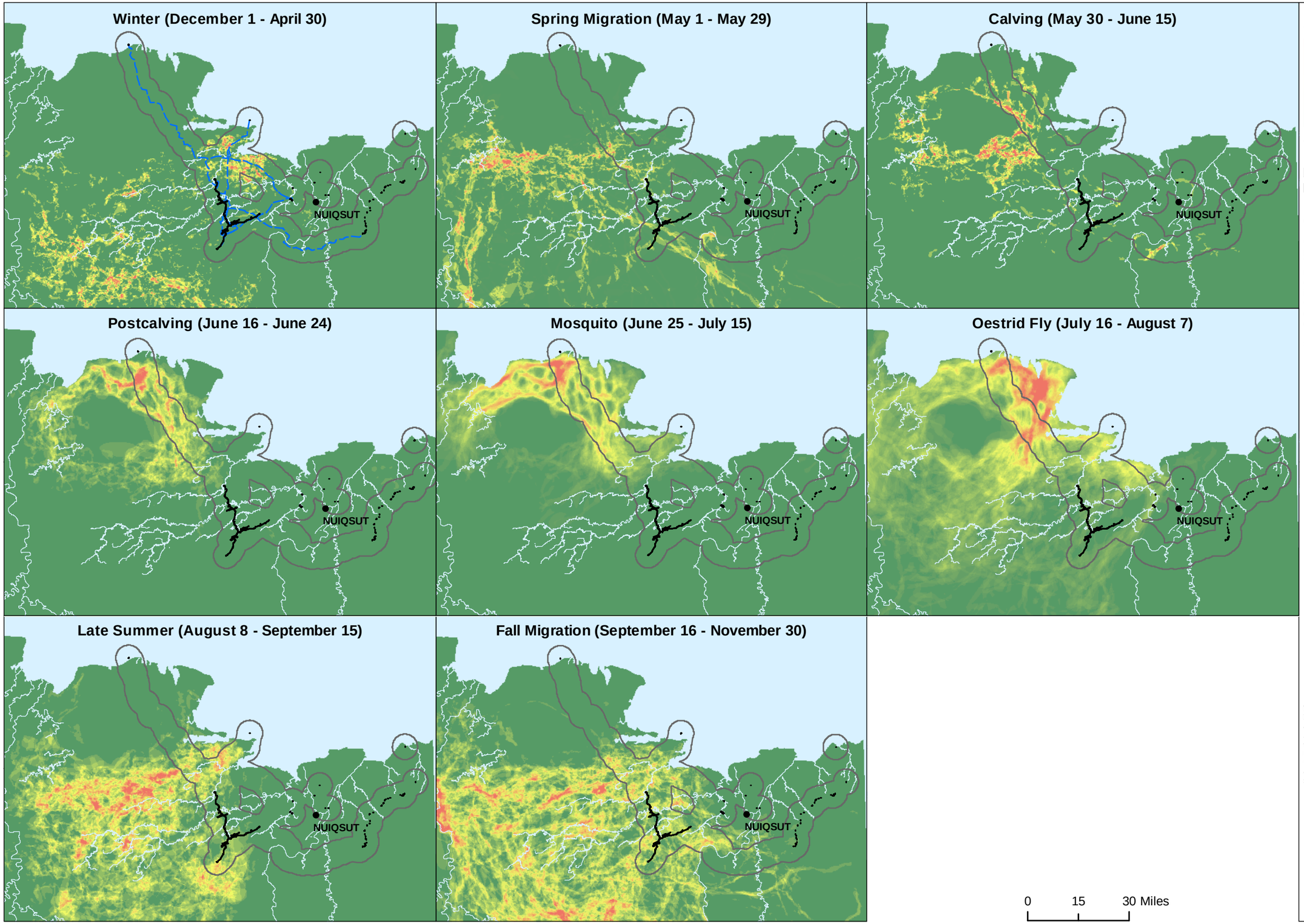
0 5 10 Miles

Figure 3.12.4



Teshekpuk Caribou Herd GPS Collars

Value

High : 58.1

Low : 0

Willow Proposed Development Features

- Ice Road
- Analysis Area
- Gravel Footprint

Note:
Locations of GPS-collared individual female caribou were used to calculate dynamic Brownian Bridge Movement Models (Kranstauber et al. 2012) using the move packagin R (Kranstauber et al. 2017, R Core Team 2019). Based on the output of these models, the 95% isopleth of movements for each individual collared caribou in the area in each season were calculated and these were used to calculate the proportion of collared caribou in the area that were using each 100-m pixel.

Source:
Prichard, Macander et al. 2018

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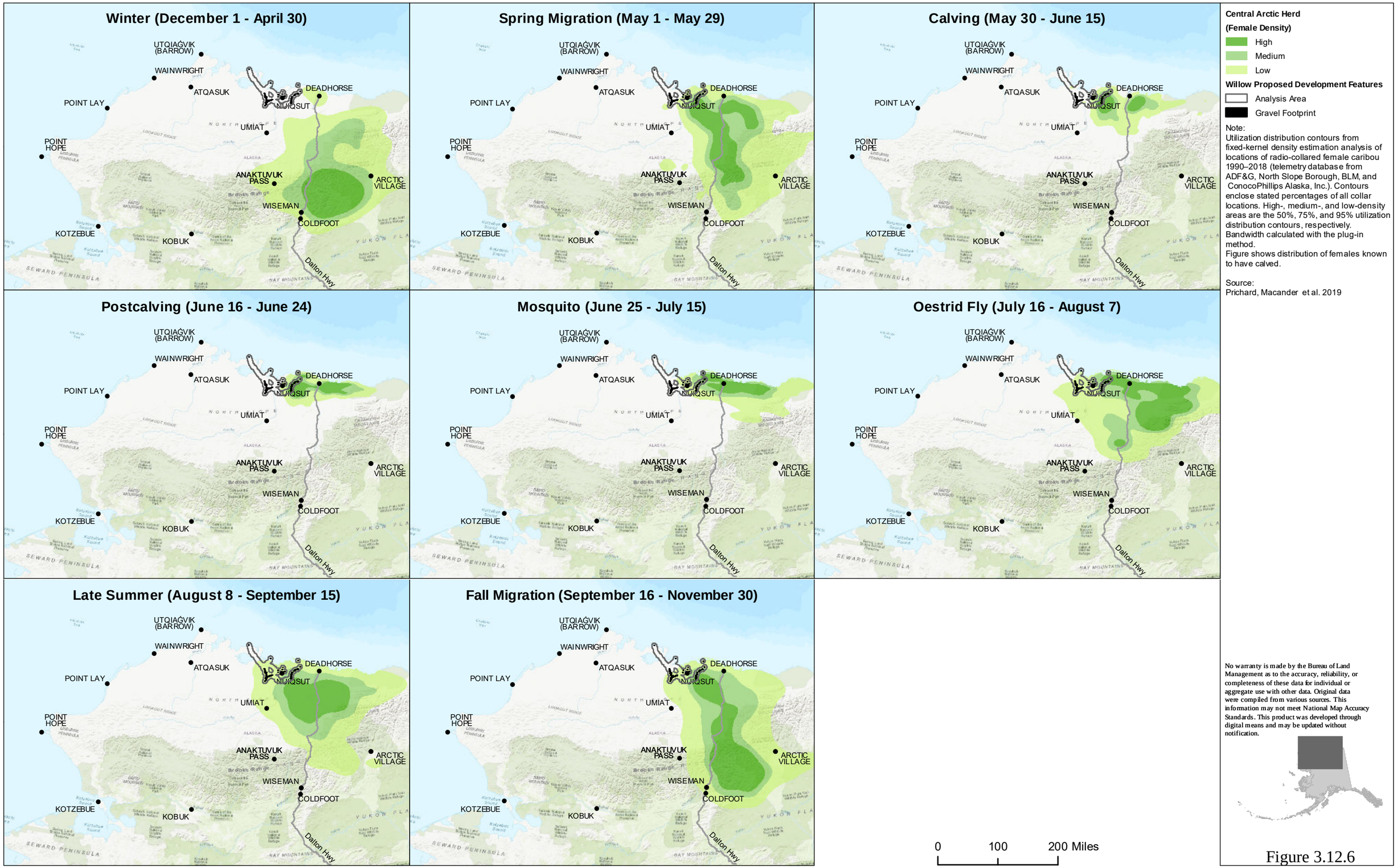
Figure 3.12.5


Winter (December 1 - April 30)
Spring Migration (May 1 - May 29)
Calving (May 30 - June 15)
Postcalving (June 16 - June 24)
Mosquito (June 25 - July 15)
Oestrid Fly (July 16 - August 7)
Late Summer (August 8 - September 15)
Fall Migration (September 16 - November 30)
UTQIAĠVIK (BARROW)
WAINWRIGHT
ATQASUK
POINT LAY
POINT HOPE
DEADHORSE
NUIQSUT
UMIAT
ANAKTUVUK PASS
ARCTIC VILLAGE
WISEMAN
COLDFOOT
KOTZEBUE
KOBUK
Dalton Hwy
SEWARD PENINSULA
Central Arctic Herd
(Female Density)
High
Medium
Low
Willow Proposed Development Features
Analysis Area
Gravel Footprint
Note:
Utilization distribution contours from fixed-kernel density estimation analysis of locations of radio-collared female caribou 1990–2018 (telemetry database from ADF&G, North Slope Borough, BLM, and ConocoPhillips Alaska, Inc.). Contours enclose stated percentages of all collar locations. High-, medium-, and low-density areas are the 50%, 75%, and 95% utilization distribution contours, respectively. Bandwidth calculated with the plug-in method.
Figure shows distribution of females known to have calved.
Source:
Prichard, Macander et al. 2019
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0
100
200 Miles

Figure 3.12.6

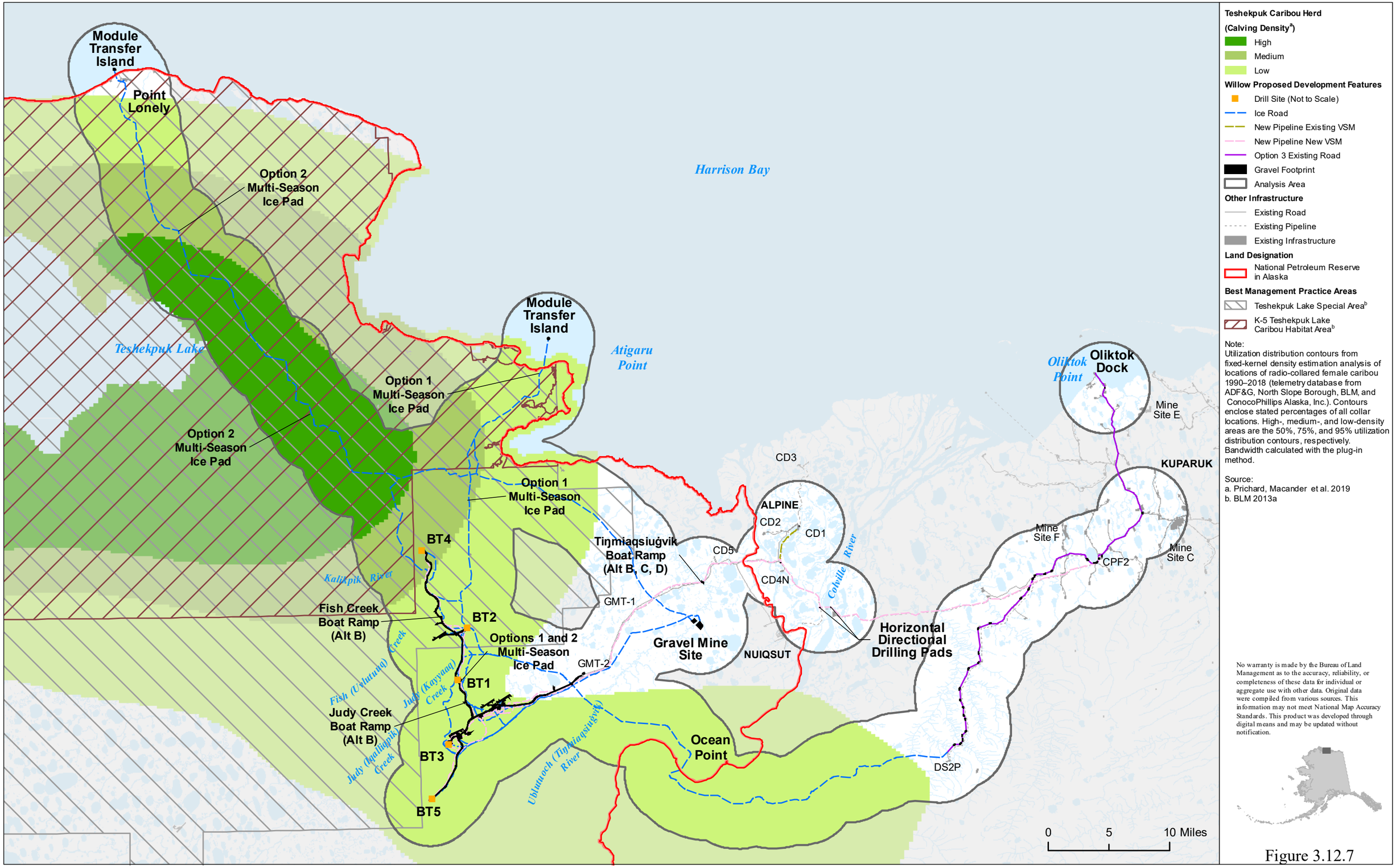
Module Transfer Island
Point Lonely
Option 2 Multi-Season Ice Pad
Harrison Bay
Teshekpuk Lake
Module Transfer Island
Atigaru Point
Option 1 Multi-Season Ice Pad
Option 2 Multi-Season Ice Pad
Oliktok Point
Oliktok Dock
Mine Site E
CD3
KUPARUK
Option 1 Multi-Season Ice Pad
ALPINE
CD2
CD1
Mine Site F
Mine Site C
CPF2
BT4
Tiŋmiaqsiuġvik Boat Ramp (Alt B, C, D)
CD5
Colville River
CD4N
Kalikpik River
GMT-1
Fish Creek Boat Ramp (Alt B)
BT2
Options 1 and 2 Multi-Season Ice Pad
Gravel Mine Site
NUIQSUT
Horizontal Directional Drilling Pads
GMT-2
Fish (Ulutuuq) Creek
Judy (Kayyaaq) Creek
BT1
Judy Creek Boat Ramp (Alt B)
Judy (Iqalliġpik) Creek
BT3
Ublutuoch (Tiŋmiaqsiuġvik) River
Ocean Point
DS2P
BT5
0 5 10 Miles
Teshekpuk Caribou Herd
(Calving Density[a])
High
Medium
Low
Willow Proposed Development Features
Drill Site (Not to Scale)
Ice Road
New Pipeline Existing VSM
New Pipeline New VSM
Option 3 Existing Road
Gravel Footprint
Analysis Area
Other Infrastructure
Existing Road
Existing Pipeline
Existing Infrastructure
Land Designation
National Petroleum Reserve in Alaska
Best Management Practice Areas
Teshekpuk Lake Special Area[b]
K-5 Teshekpuk Lake Caribou Habitat Area[b]
Note:
Utilization distribution contours from fixed-kernel density estimation analysis of locations of radio-collared female caribou 1990–2018 (telemetry database from ADF&G, North Slope Borough, BLM, and ConocoPhillips Alaska, Inc.). Contours enclose stated percentages of all collar locations. High-, medium-, and low-density areas are the 50%, 75%, and 95% utilization distribution contours, respectively. Bandwidth calculated with the plug-in method.
Source:
a. Prichard, Macander et al. 2019
b. BLM 2013a
No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources. This information may not meet National Map Accuracy Standards. This product was developed through digital means and may be updated without notification.

Figure 3.12.7

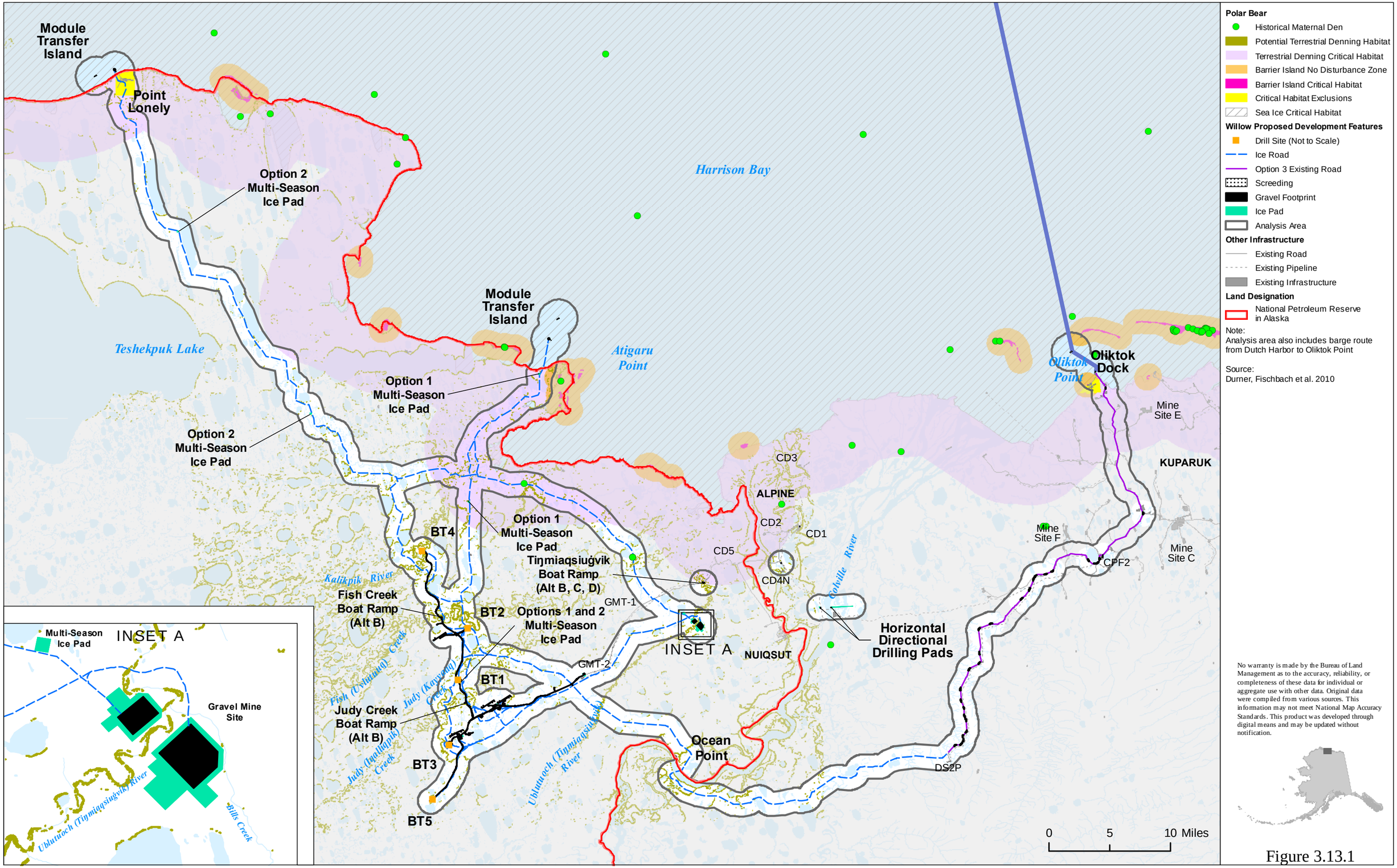
Module Transfer Island
Point Lonely
Option 2 Multi-Season Ice Pad
Harrison Bay
Teshekpuk Lake
Module Transfer Island
Atigaru Point
Option 1 Multi-Season Ice Pad
Option 2 Multi-Season Ice Pad
Oliktok Point
Oliktok Dock
Mine Site E
KUPARUK
CD3
ALPINE
CD2
CD1
CD5
CD4N
Colville River
Mine Site F
Mine Site C
CPF2
Option 1 Multi-Season Ice Pad
Tiŋmiaqsiuġvik Boat Ramp (Alt B, C, D)
BT4
Kalikpik River
Fish Creek Boat Ramp (Alt B)
BT2
Options 1 and 2 Multi-Season Ice Pad
GMT-1
GMT-2
INSET A
NUIQSUT
Horizontal Directional Drilling Pads
BT1
Judy Creek Boat Ramp (Alt B)
BT3
BT5
Ocean Point
DS2P
Ublutuoch (Tiŋmiaqsiuġvik) River
0 5 10 Miles
Multi-Season Ice Pad
Gravel Mine Site
Bills Creek
Polar Bear
Historical Maternal Den
Potential Terrestrial Denning Habitat
Terrestrial Denning Critical Habitat
Barrier Island No Disturbance Zone
Barrier Island Critical Habitat
Critical Habitat Exclusions
Sea Ice Critical Habitat
Willow Proposed Development Features
Drill Site (Not to Scale)
Ice Road
Option 3 Existing Road
Screeding
Gravel Footprint
Ice Pad
Analysis Area
Other Infrastructure
Existing Road
Existing Pipeline
Existing Infrastructure
Land Designation
National Petroleum Reserve in Alaska
Note:
Analysis area also includes barge route from Dutch Harbor to Oliktok Point
Source:
Durner, Fischbach et al. 2010
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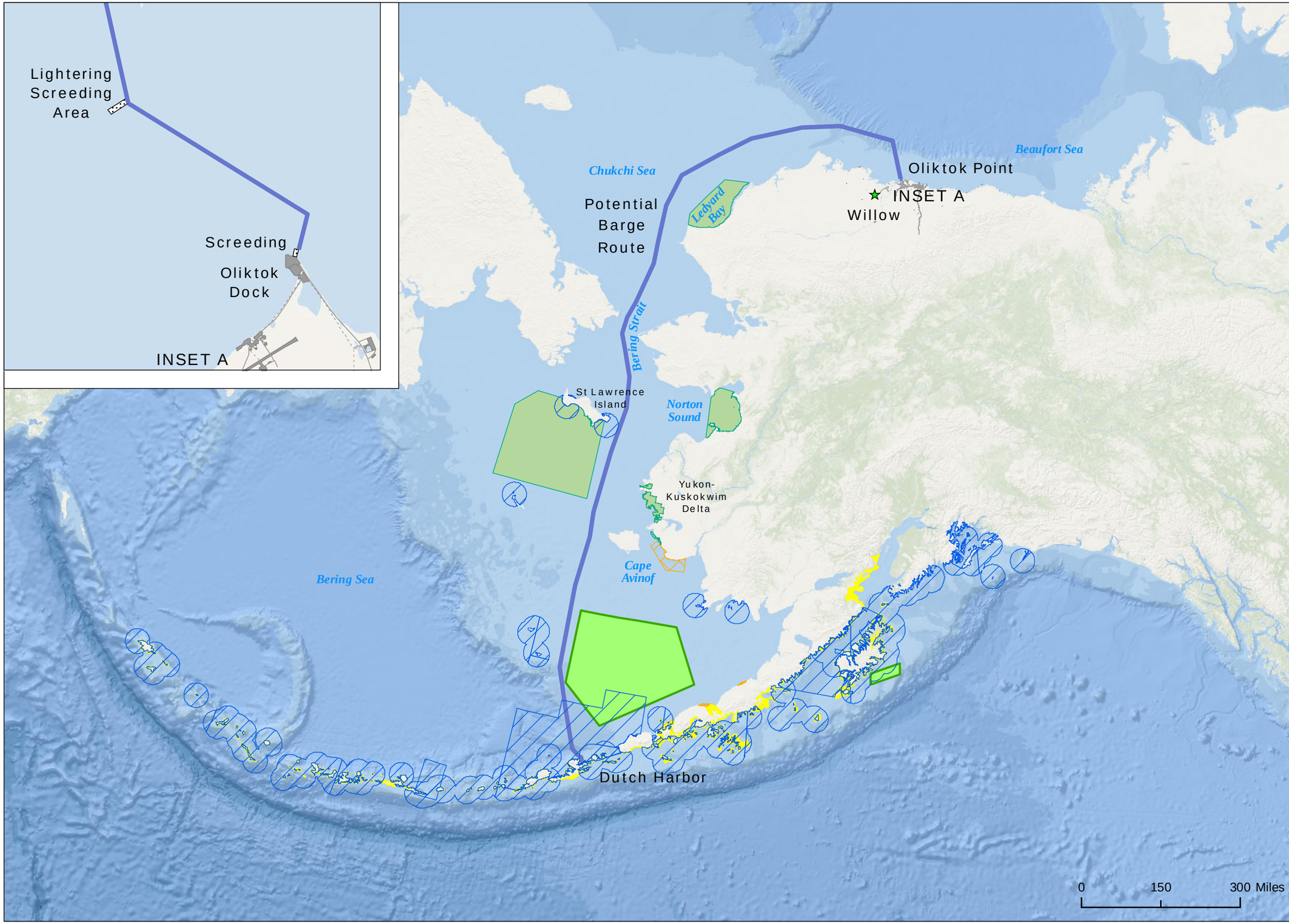
Figure 3.13.1



Potential Marine Vessel Route

Potential Vessel Route

National Marine Fisheries Service Critical Habitat

Stellar Sea Lion Critical Habitat (Foraging area and 20 nautical mile aquatic zone)

North Pacific Right Whale Critical Habitat

United States Fish and Wildlife Service Critical Habitat

Sea Otter Critical Habitat

Steller's Eider Critical Habitat

Spectacled Eider Critical Habitat

Willow Proposed Development Features

Willow Project

Screeding

Other Infrastructure

Existing Road

Note: Action Area encompasses a 1.5 mile radius around barge route, support vessel route, screeding and 1 mile radius around onshore project components.

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Figure 3.13.2

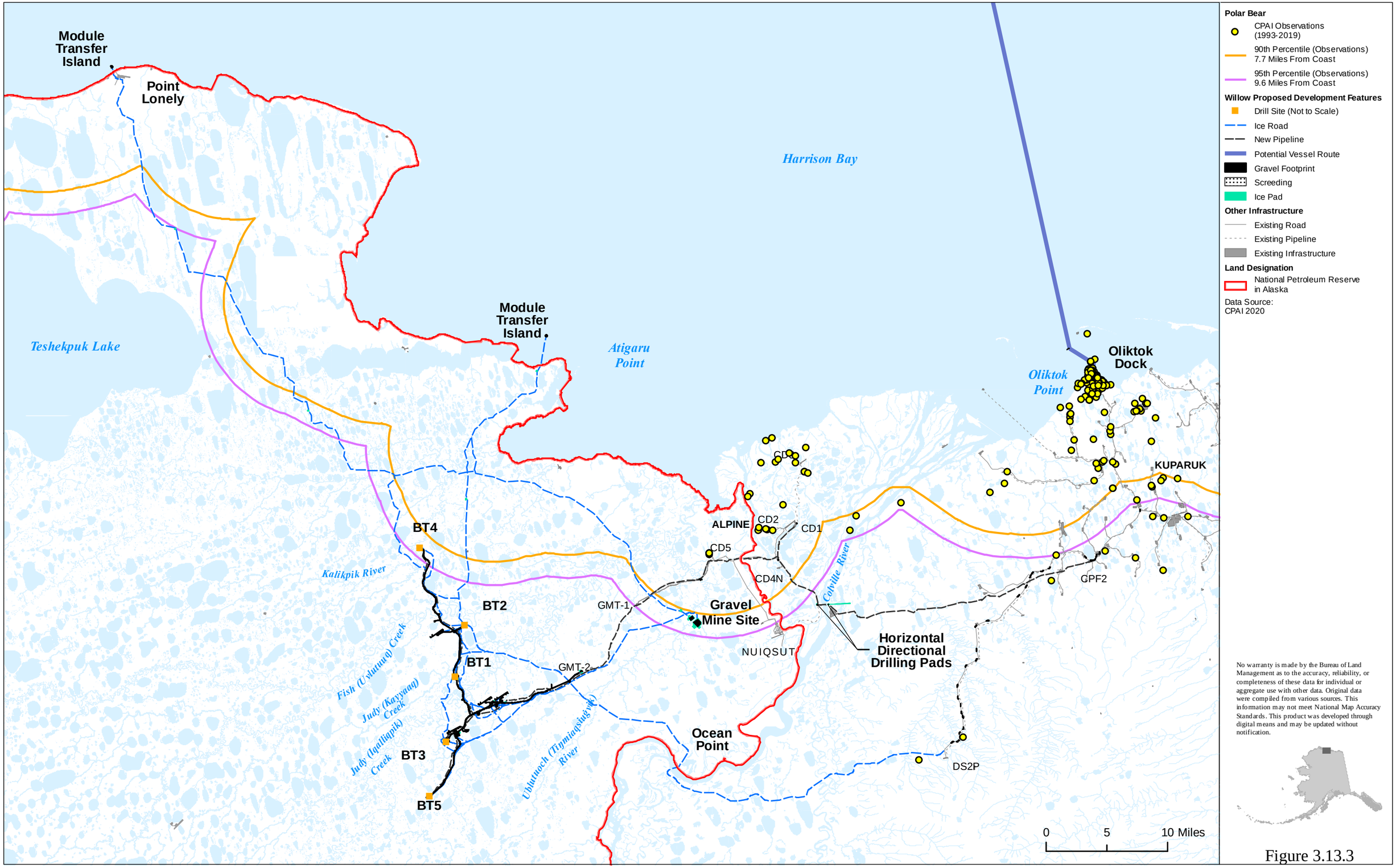
Module Transfer Island
Point Lonely
Harrison Bay
Teshekpuk Lake
Module Transfer Island
Atigaru Point
Oliktok Dock
Oliktok Point
KUPARUK
CD3
ALPINE
CD2
CD1
CD5
CD4N
Colville River
GPF2
BT4
Kalikpik River
BT2
GMT-1
Gravel Mine Site
NUIQSUT
Horizontal Directional Drilling Pads
BT1
GMT-2
Fish (Usuluuq) Creek
Judy (Kayyaaq) Creek
Judy (Iqalliqpik) Creek
BT3
Ublutuoch (Tinmiaqsiuqvik) River
Ocean Point
DS2P
BT5
0
5
10 Miles
Polar Bear
CPAI Observations (1993-2019)
90th Percentile (Observations) 7.7 Miles From Coast
95th Percentile (Observations) 9.6 Miles From Coast
Willow Proposed Development Features
Drill Site (Not to Scale)
Ice Road
New Pipeline
Potential Vessel Route
Gravel Footprint
Screeding
Ice Pad
Other Infrastructure
Existing Road
Existing Pipeline
Existing Infrastructure
Land Designation
National Petroleum Reserve in Alaska
Data Source: CPAI 2020
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Figure 3.13.3

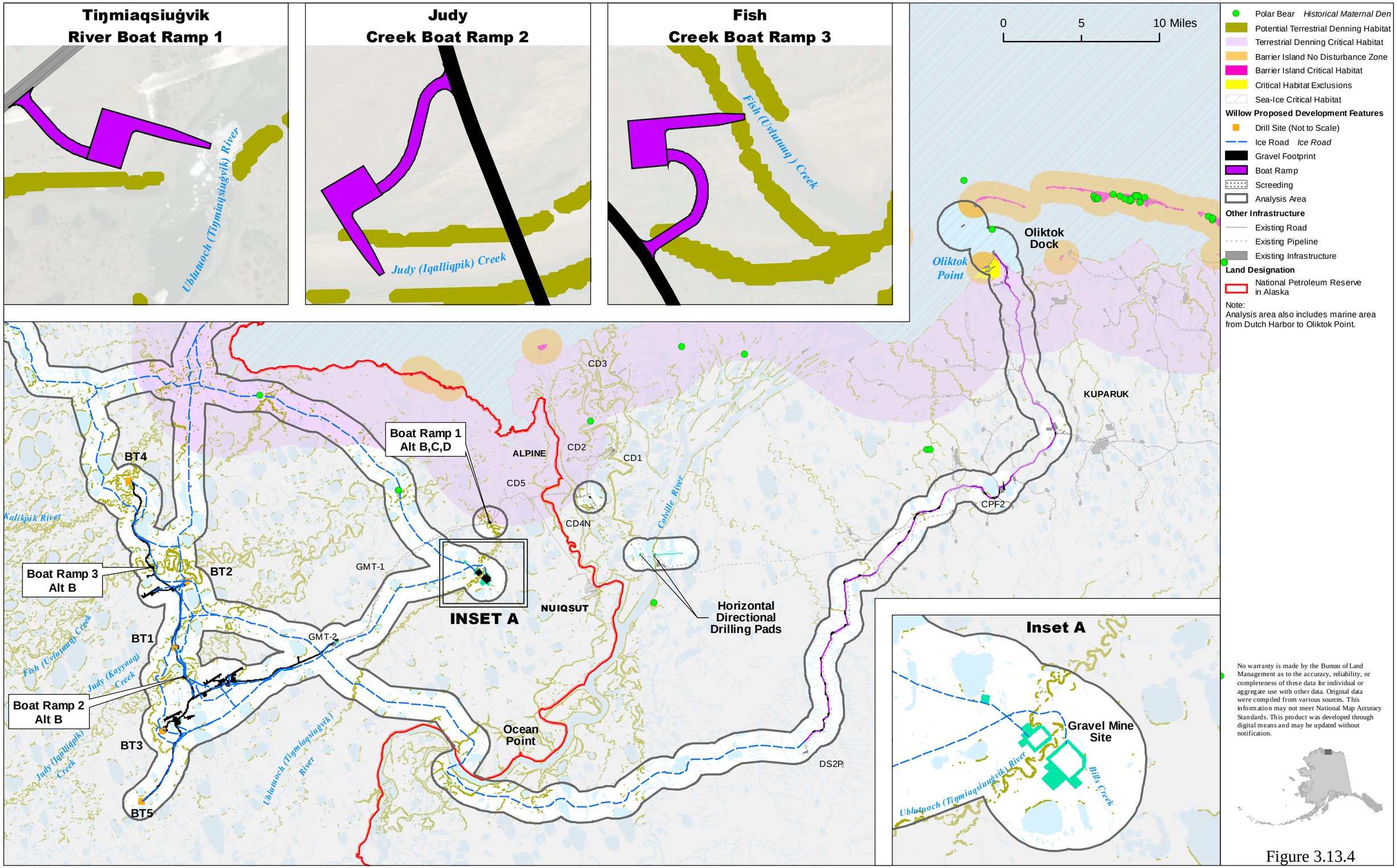
Tiŋmiaqsiuġvik River Boat Ramp 1
Ublutuoch (Tiŋmiaqsiuġvik) River
Judy Creek Boat Ramp 2
Judy (Iqalliqpik) Creek
Fish Creek Boat Ramp 3
Fish (Uvlutuuq) Creek
0 5 10 Miles
Polar Bear Historical Maternal Den
Potential Terrestrial Denning Habitat
Terrestrial Denning Critical Habitat
Barrier Island No Disturbance Zone
Barrier Island Critical Habitat
Critical Habitat Exclusions
Sea-Ice Critical Habitat
Willow Proposed Development Features
Drill Site (Not to Scale)
Ice Road Ice Road
Gravel Footprint
Boat Ramp
Screeding
Analysis Area
Other Infrastructure
Existing Road
Existing Pipeline
Existing Infrastructure
Land Designation
National Petroleum Reserve in Alaska
Note:
Analysis area also includes marine area from Dutch Harbor to Oliktok Point.
Oliktok Dock
Oliktok Point
KUPARUK
CD3
ALPINE
CD2
CD1
CD5
CD4N
CPF2
Cobville River
Boat Ramp 1 Alt B,C,D
BT4
Kalikpik River
Boat Ramp 3 Alt B
BT2
GMT-1
INSET A
NUIQSUT
Horizontal Directional Drilling Pads
BT1
GMT-2
Fish (Uvlutuuq) Creek
Judy (Kayyaaq) Creek
Boat Ramp 2 Alt B
BT3
Judy (Iqalliqpik) Creek
Ublutuoch (Tiŋmiaqsiuġvik) River
Ocean Point
DS2P
BT5
Inset A
Gravel Mine Site
Bills Creek
Ublutuoch (Tiŋmiaqsiuġvik) River
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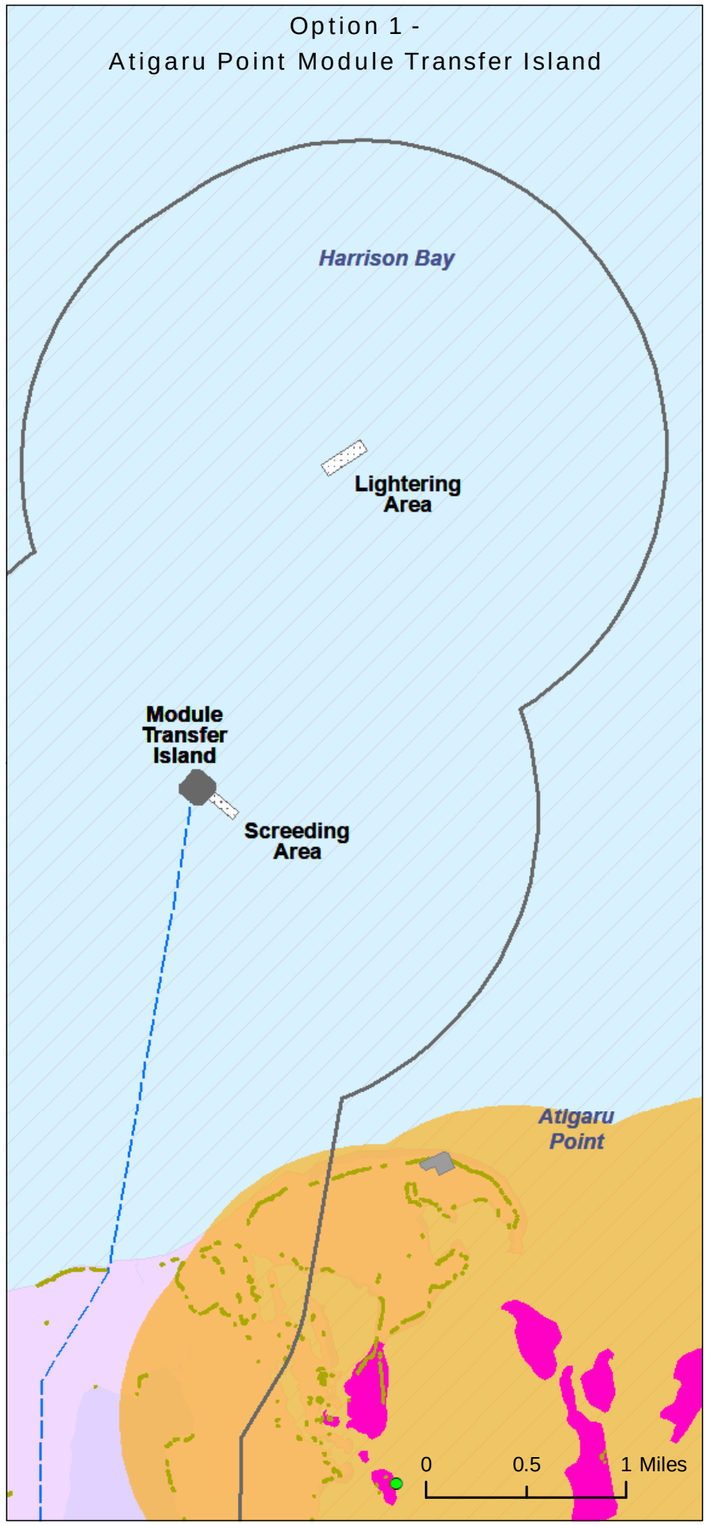
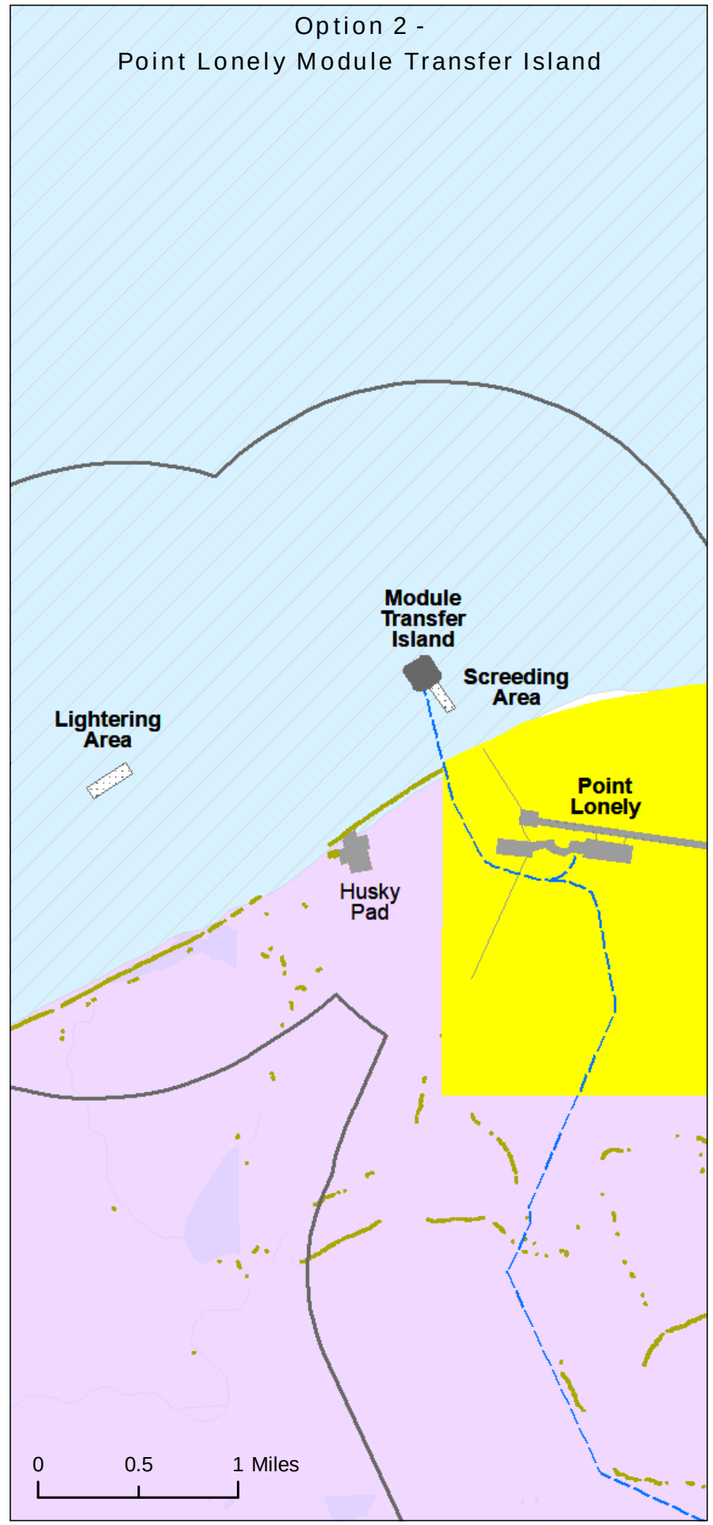
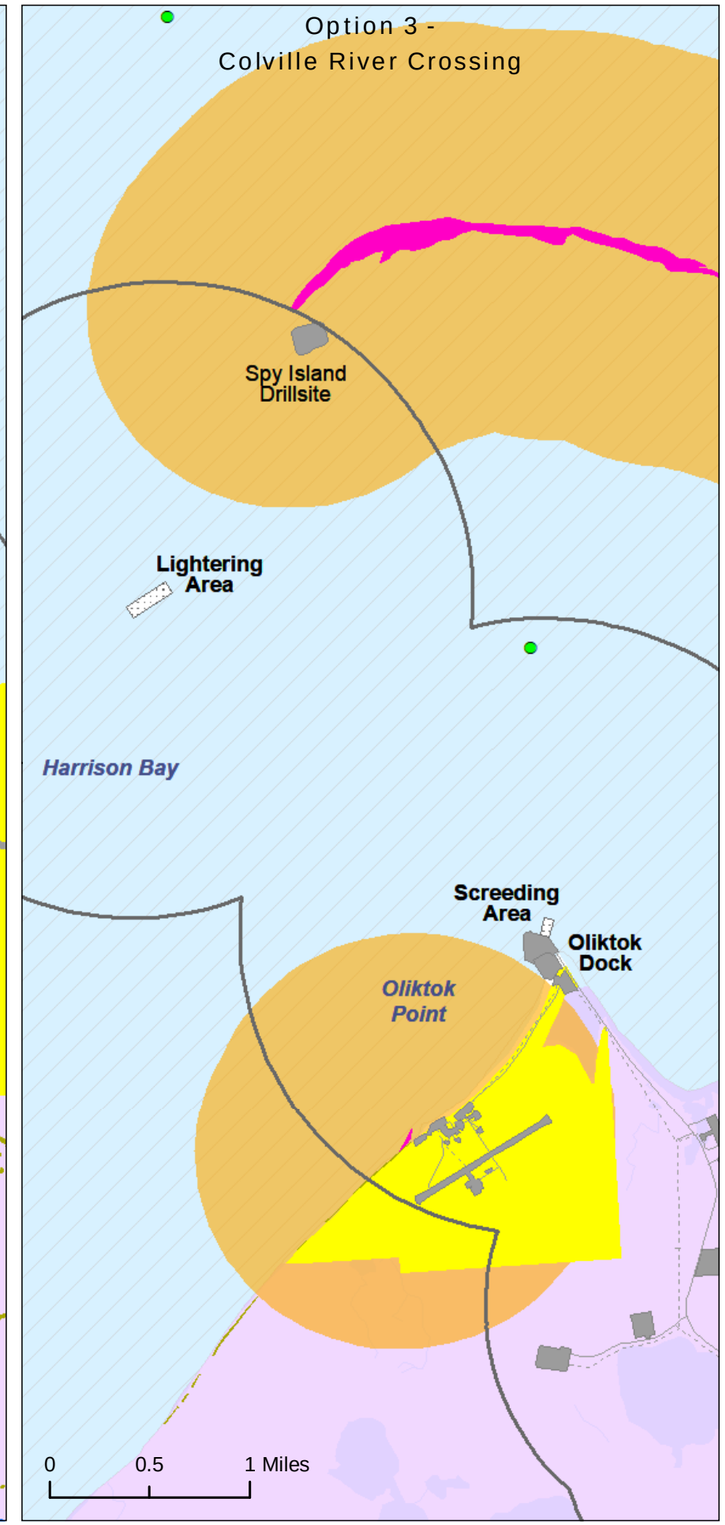
Figure 3.13.4







Polar Bear
- Historical Maternal Den
- Potential Terrestrial Denning Habitat
- Terrestrial Denning Critical Habitat
- Barrier Island No Disturbance Zone
- Barrier Island Critical Habitat
- Critical Habitat Exclusions
- Sea-Ice Critical Habitat

Willow Proposed Development Features
- Ice Road
- Screeding
- Analysis Area

Other Infrastructure
- Existing Road
- Existing Pipeline
- Existing Infrastructure

Notes:
1. Oliktok Dock activity would occur under all action alternatives and Option 3: Colville River Crossing.

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Figure 3.13.5

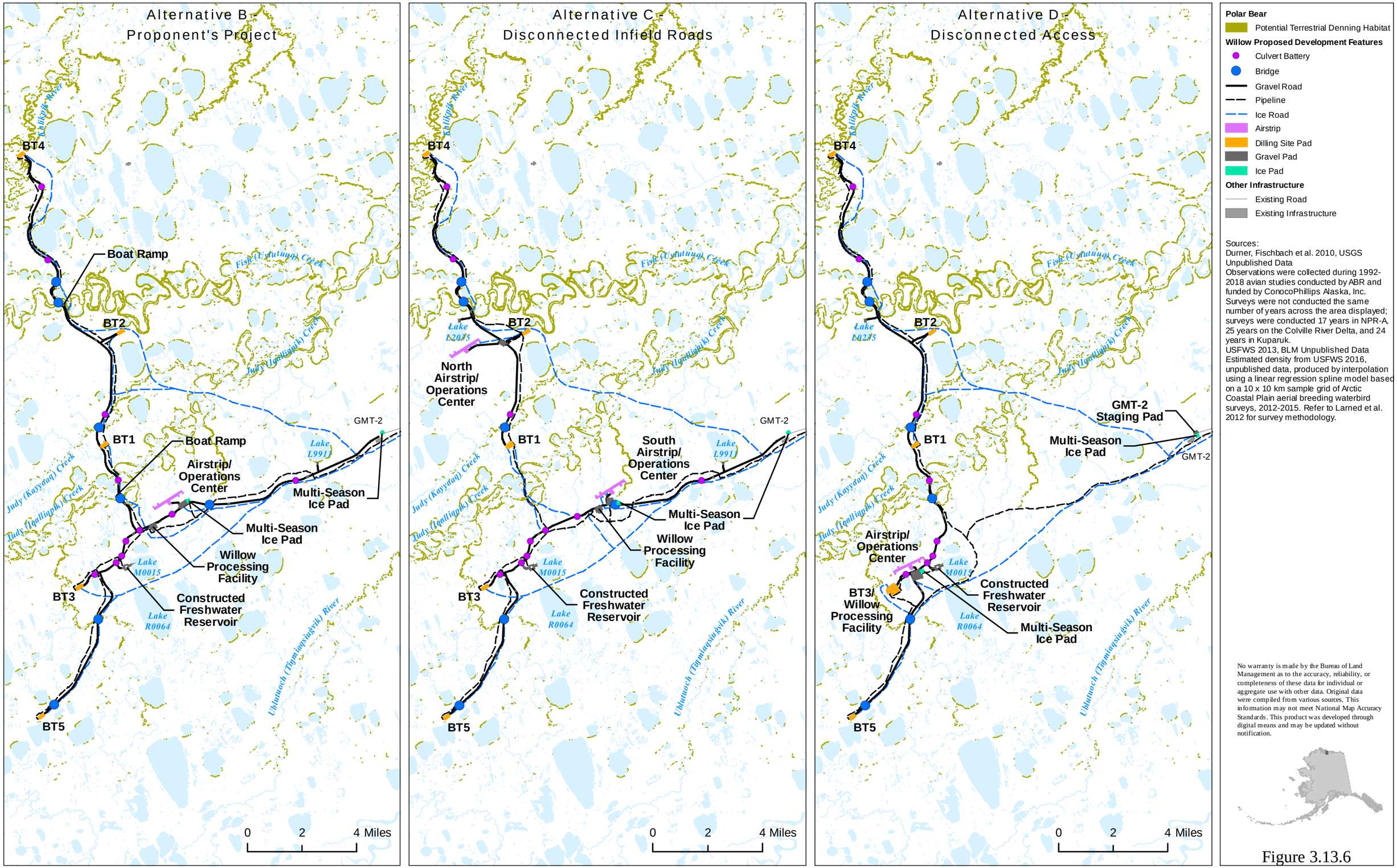
Alternative B - Proponent's Project
Alternative C - Disconnected Infield Roads
Alternative D - Disconnected Access
Kalikpik River
Fish (Uyuituum) Creek
Judy (Iqalliapik) Creek
Judy (Kayyaaq) Creek
Ublutuoch (Tiqmiaqsiugvik) River
BT1
BT2
BT3
BT4
BT5
Boat Ramp
Airstrip/ Operations Center
North Airstrip/ Operations Center
South Airstrip/ Operations Center
Multi-Season Ice Pad
Willow Processing Facility
Constructed Freshwater Reservoir
BT3/ Willow Processing Facility
GMT-2
GMT-2 Staging Pad
Lake L0275
Lake L991
Lake M0015
Lake R0064
0 2 4 Miles
Polar Bear
Potential Terrestrial Denning Habitat
Willow Proposed Development Features
Culvert Battery
Bridge
Gravel Road
Pipeline
Ice Road
Airstrip
Dilling Site Pad
Gravel Pad
Ice Pad
Other Infrastructure
Existing Road
Existing Infrastructure
Sources:
Durner, Fischbach et al. 2010, USGS Unpublished Data
Observations were collected during 1992-2018 avian studies conducted by ABR and funded by ConocoPhillips Alaska, Inc. Surveys were not conducted the same number of years across the area displayed; surveys were conducted 17 years in NPR-A, 25 years on the Colville River Delta, and 24 years in Kuparuk.
USFWS 2013, BLM Unpublished Data
Estimated density from USFWS 2016, unpublished data, produced by interpolation using a linear regression spline model based on a 10 x 10 km sample grid of Arctic Coastal Plain aerial breeding waterbird surveys, 2012-2015. Refer to Larned et al. 2012 for survey methodology.
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Figure 3.13.6